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SAN FRANCISCO BAY AREA IN-DEPTH STUDY

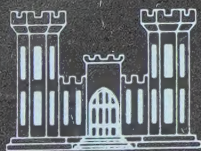
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WATERBORNE COMMERCE PROJECTIONS AND COMMODITY FLOW ANALYSIS FOR THE SAN FRANCISCO BAY REGION

SEPTEMBER 1976



U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

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 Shipping

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I. INTRODUCTION

A. PURPOSE AND SCOPE

This commodity flow analysis provides a range of waterborne commerce projections for the San Francisco Bay Area In-Depth Study. The projections will be used by the Corps' San Francisco District as basic data for evaluation in other study elements of the In-Depth Study.

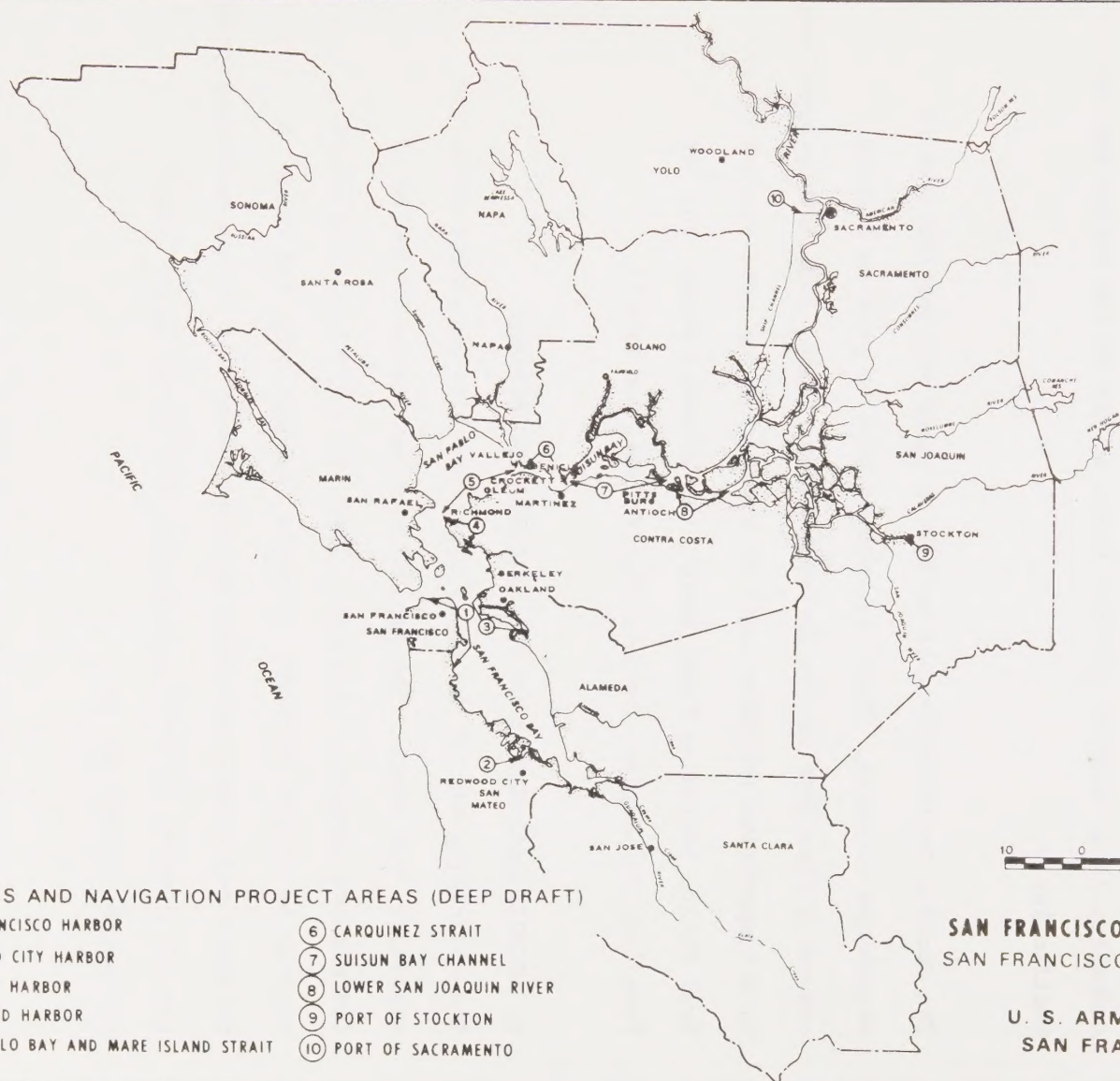
The other study elements are as follows:

- a. Vessels and Port Facilities Analysis
- b. Transportation Systems Assessment
- c. Environmental Assessment
- d. Socio-Economic Assessment
- e. National Defense Assessment
- f. Legal and Institutional Considerations

The commodity flow analysis considers a range of tonnage projections for exports, imports, coastwise shipments and coastwise receipts, by major commodity groups and mode of shipment. Shipment methods presented are break bulk, container/LASH, liquid bulk and dry bulk. Projected tonnages (in short tons) are for the years 1980, 2000, and 2020. The projections are not assigned monetary values.

All waterborne commodities are included in this study except crude petroleum (group 13); sand, gravel and crushed rock (commodity 1442); fresh fish and other marine products (group 09); and Department of Defense controlled cargo and special category items (group 9999). Crude petroleum has been separately analyzed in the Corps' West Coast Deepwater Port Facilities Study prepared jointly by the South Pacific and North Pacific Divisions in June 1973. Further consideration of liquefied natural gas and crude petroleum has been deferred.

The scope of this study focuses primarily on the "San Francisco Bay Region". The analysis divides the Bay Region into two subareas, one of which encompasses all commodity movements in the "San Francisco Bay Area" including the Harbors of Oakland, San Francisco, Richmond and Redwood City, and movements in San Pablo Bay, Mare Island and Carquinez Strait. The other subarea, the "Delta Area", includes movements in Suisun Bay and the San Joaquin and Sacramento Rivers above Antioch extending to the Ports of Sacramento and Stockton. While data were compiled by ports, projections were not made for individual ports in the Bay Region System. Projections involved only designated commodities in and out of the Golden Gate. Plate I is a map of the San Francisco Bay Region harbor system.



B. PACIFIC BASIN COMMODITY FLOW STUDY

The San Francisco Bay Area In-Depth commodity flow analysis presented in this report represents an integrated step of a larger effort. The Corps' three Pacific Divisions are conducting a joint study of commodity flows between the West Coast of the United States and the Pacific Basin.

The Pacific Basin Study will analyze origins and destinations of waterborne commerce. This information will be used to firm-up commodity flow data of the In-Depth study. Also, long term projections in a competitive framework will be made for major port systems on the West Coast, including Puget Sound, the Columbia River, the San Francisco Bay Region, Southern California, and Hawaii.

C. CONDITIONAL NATURE OF THE IN-DEPTH PROJECTIONS

The overriding aim of the study projections is to reveal direction, magnitude, and range. The projections are static estimates of dynamic and complex conditions. They are subject to conditions imposed by choice, methods, concepts, assumptions, and time. A multiple regression technique was used because it seemed more appropriate for the problem at hand; recognizing that there is no "best" projection method per se.

The terms, "high", "medium", and "low", projections are relative to historical data analysis and do not constitute an absolute upper

or lower bound. The major projection assumptions are specified, whenever practical additional exogenous factors are introduced to offset the deterministic and mechanical results of the methodology. Because of the uncertainty about the future, the effective life of the projections may be quite short. Further adjustments may be needed as conditions warrant.

II. DATA BASE AND DATA SOURCES

A. DEVELOPMENT OF BASIC DATA

A large amount of data and information was collected for this study. While maximum use of the compilations was not possible, this data will serve as a base for ongoing (Pacific Basin) projection analyses. Following is a brief summary of the data developed.

Historical commodity tonnages, by type of movement, for the San Francisco Bay Area and Delta Area were determined for the years 1950-1973. The source for this data was the Waterborne Commerce of the United States, Part IV Waterways and Harbors Pacific Coast, Alaska and Hawaii. This annual publication presents harbor and waterway tonnage movements (i.e., imports, exports, coastwise receipts and shipments, and internal receipts and shipments) by a four-digit commodity code. The first two digits of this code indicate the major commodity group, while the second two digits designate the specific commodities. Listing Number 1 shows these classifications and their component commodities. It should be noted that the classification code was changed in 1965. Therefore, commodity tonnage data for the years prior to 1965 had to be reassigned to the new classification codes. The Waterborne Commerce Statistics Center furnished the information needed to convert the 1964 codes to 1965 codes. Judgement was used in some instances, as the old code required division between two

Listing Number 1
Waterborne Commerce of the United States
Commodity Classification for Shipping Statistics

Group 01 - Farm Products--Continued

<u>Code No.</u>	<u>Item Name</u>
0105	Rice
0106	Sorghum grains
0107	Wheat
0111	Soybeans
0112	Flaxseed
0119	Oilseeds, not elsewhere classified
0121	Tobacco, leaf
0122	Hay and fodder
0129	Field crops, not elsewhere classified
0131	Fresh fruits and tree nuts, except bananas and plantains
0132	Bananas and plantains
0133	Coffee, green and roasted, (including instant)
0134	Cocoa beans
0141	Fresh and frozen vegetables
0151	Live animals (livestock), except zoo animals, cats, dogs, etc.
0161	Animals and animal products, not elsewhere classified
0191	Miscellaneous farm products

Group 08 - Forest Products

0841	Crude rubber and allied gums
0861	Forest products, not elsewhere classified

Group 09 - Fresh Fish and Other Marine Products

0911	Fresh fish, except shellfish
0912	Shellfish, except prepared or preserved
0913	Menhaden
0931	Marine shells, unmanufactured

Group 10 - Metallic Ores

1011	Iron ore and concentrates
1021	Copper ore and concentrates
1051	Bauxite and other aluminum ores and concentrates
1061	Manganese ores and concentrates
1091	Nonferrous metal ores and concentrates, not elsewhere classified

Group 11 - Coal

1121	Coal and lignite
------	------------------

Group 13 - Crude Petroleum

1311	Crude petroleum
------	-----------------

Group 14 - Nonmetallic Minerals, Except Fuels

1411	Limestone flux and calcareous stone
1412	Building stone, unworked
1442	Sand, gravel and crushed rock
1451	Clay, ceramic and refractory materials
1471	Phosphate rock
1479	Natural fertilizer materials, not elsewhere classified
1491	Salt
1492	Sulphur, dry
1493	Sulphur, liquid
1494	Gypsum, crude and plasters
1499	Nonmetallic minerals, except fuels, not elsewhere classified

Group 19 - Ordnance and Accessories

1911	Ordnance and accessories
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Group 20 - Food and Kindred Products

2011	Meat, fresh, chilled, or frozen
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Group 20 - Food and Kindred Products--Continued

<u>Code No.</u>	<u>Item Name</u>
2012	Meat and meat products prepared or preserved, including canned meat products
2014	Tallow, animal fats and oils
2015	Animal by-products, not elsewhere classified
2021	Dairy products, except dried milk and cream
2022	Dried milk and cream
2031	Fish and fish products, including shellfish, prepared or preserved
2034	Vegetables and preparations, canned and otherwise prepared and preserved
2039	Fruits and fruit and vegetable juices, canned and otherwise prepared or preserved
2041	Wheat flour and semolina
2042	Prepared animal feeds
2049	Grain mill products, not elsewhere classified
2061	Sugar
2062	Molasses
2081	Alcoholic beverages
2091	Vegetable oils, all grades; margarine and shortening
2092	Animal oils and fats, not elsewhere classified, including marine
2094	Groceries
2095	Ice
2099	Miscellaneous food products

Group 21 - Tobacco Products

2111	Tobacco manufactures
------	----------------------

Group 22 - Basic Textiles

2211	Basic textile products, except textile fibers
2212	Textile fibers, not elsewhere classified

Group 23 - Apparel and Other Finished Textile Products, Including Knit

2311	Apparel and other finished textile products, including knit
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Group 24 - Lumber and Wood Products, Except Furniture

2411	Logs
2412	Rafted logs
2413	Fuel wood, charcoal, and wastes
2414	Timber, posts, poles, piling, and other wood in the rough
2415	Pulpwood, log
2416	Wood chips, staves, moldings, and excelsior
2421	Lumber
2431	Veneer, plywood, and other worked wood
2491	Wood manufactures, not elsewhere classified

Group 25 - Furniture and Fixtures

2511	Furniture and fixtures
------	------------------------

Group 26 - Pulp, Paper and Allied Products

2611	Pulp
2621	Standard newsprint paper
2631	Paper and paperboard
2691	Pulp, paper and paperboard products, not elsewhere classified

Group 27 - Printed Matter

2711	Printed Matter
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Listing Number 1
Waterborne Commerce of the United States
Commodity Classification for Shipping Statistics

Group 28 - Chemicals and Allied Products

Code No.	Item Name
2810	Sodium hydroxide (caustic soda)
2811	Crude products from coal tar, petroleum, and natural gas, except benzene and toluene
2812	Dyes, organic pigment, dyeing and tanning materials
2813	Alcohols
2816	Radioactive and associated materials, including wastes
2817	Benzene and toluene, crude and commercially pure
2818	Sulphuric acid
2819	Basic chemicals and basic chemical products, not elsewhere classified
2821	Plastic materials, regenerated cellulose and synthetic resins, including film, sheeting, and laminates
2822	Synthetic rubber
2823	Synthetic (man-made) fiber
2831	Drugs (biological products, medicinal chemicals, botanical products and pharmaceutical preparations)
2841	Soap, detergents, and cleaning preparations; perfumes, cosmetics and other toilet preparations
2851	Paints, varnishes, lacquers, enamels, and allied products
2861	Gum and wood chemicals
2871	Nitrogenous chemical fertilizers, except mixtures
2872	Potassic chemical fertilizers, except mixtures
2873	Phosphatic chemical fertilizers, except mixtures
2876	Insecticides, fungicides, pesticides, and disinfectants
2879	Fertilizers and fertilizer materials, not elsewhere classified
2891	Miscellaneous chemical products

Group 29 - Petroleum and Coal Products

2911	Gasoline, including natural gasoline
2912	Jet fuel
2913	Kerosene
2914	Distillate fuel oil
2915	Residual fuel oil
2916	Lubricating oils and greases
2917	Naphtha, mineral spirits, solvents, not elsewhere classified
2918	Asphalt, tar, and pitches
2920	Coke, including petroleum coke
2921	Liquefied petroleum gases, coal gases, natural gas, and natural gas liquids
2951	Asphalt building materials
2991	Petroleum and coal products, not elsewhere classified

Group 30 - Rubber and Miscellaneous
Plastics Products

3011	Rubber and miscellaneous plastics products
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Group 31 - Leather and Leather Products

3111	Leather and leather products
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Group 32 - Stone, Clay, Glass, and
Concrete Products

3211	Glass and glass products
3241	Building cement
3251	Structural clay products, including refractories
3271	Lime
3281	Cut stone and stone products
3291	Miscellaneous nonmetallic mineral products

Group 33 - Primary Metal Products

3311	Pig iron
3312	Slag
3313	Coke (coal and petroleum), petroleum pitches and asphalts, and naphtha and solvents
3314	Iron and steel ingots, and other primary forms including blanks for tube and pipe, and sponge iron

Group 33 - Primary Metal Products--Continued

Code No.	Item Name
3315	Iron and steel bars, rods, angles, shapes and sections, including sheet piling
3316	Iron and steel plates and sheets
3317	Iron and steel pipe and tube
3318	Ferroalloys
3319	Primary iron and steel products, not elsewhere classified, including castings in the rough
3321	Nonferrous metals primary smelter products, basic shapes, wire, castings and forgings, except copper, lead, zinc and aluminum
3322	Copper and copper alloys, whether or not refined, unworked
3323	Lead and zinc including alloys, unworked
3324	Aluminum and aluminum alloys, unworked

Group 34 - Fabricated Metal Products, Except
Ordnance, Machinery, and Transportation Equipment

3411	Fabricated metal products, except ordnance, machinery, and transportation equipment
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Group 35 - Machinery, Except Electrical

3511	Machinery, except electrical
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Group 36 - Electrical Machinery, Equipment and Supplies

3611	Electrical machinery, equipment and supplies
------	--

Group 37 - Transportation Equipment

3711	Motor vehicles, parts and equipment
3721	Aircraft and parts
3731	Ships and boats
3791	Miscellaneous transportation equipment

Group 38 - Instruments, Photographic and Optical
Goods, Watches and Clocks

3811	Instruments, photographic and optical goods, watches and clocks
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Group 39 - Miscellaneous Products of Manufacturing

3911	Miscellaneous products of manufacturing
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Group 40 - Waste and scrap Materials

4011	Iron and steel scrap
4012	Nonferrous metal scrap
4022	Textile waste, scrap, and sweepings
4024	Paper waste and scrap
4029	Waste and scrap, not elsewhere classified

Group 41 - Special Items

4111	Water
4112	Miscellaneous shipments not identifiable by commodity
4113	LCL freight
4118	Materials used in waterway improvement, Government materials
9999	*Department of Defense controlled cargo and special category items

*Cargoes exported on Department of Defense controlled vessels (other than goods for the use of U. S. Armed Forces abroad) and non-Department of Defense shipments of military component items (abbreviated SCI) for which commodity detail is not furnished to the Corps of Engineers.

new codes, which resulted in the combining of some commodity categories. However, the 1964 to 1965 conversion was accomplished with a minimum of distortion. Appendix C presents the new-to-old and old-to-new code conversions. The port tonnages were tabulated for foreign imports and exports, as well as coastwise receipts and shipments, by two-digit commodity groups and by selected individual commodities (i.e., four-digit classification). Only those individual commodities whose tonnage accounted for five percent or more of the total for 1970 were selected. Also, crude petroleum (commodity group number 13); sand, gravel, and crushed rock (commodity group number 1442); fresh fish (commodity group number 09); and Department of Defense controlled cargo (commodity group 9999) were excluded from the tabulations.

In addition to the above mentioned data, the Waterborne Commerce Statistics Center supplied, for the years 1970 and 1972, aggregated commodity tonnages for the regional port systems of Northern California, Southern California, and the Pacific Northwest. The Northern California regional port system was further divided into the San Francisco Bay Area, Delta Area, and Coastal sub-systems. These commodity tonnages detailed foreign imports and exports, and coastwise receipts and shipments.

B. ORIGIN AND DESTINATION ANALYSIS OF FOREIGN AND DOMESTIC TRADE

Data on the origin and destination of foreign trade were developed from two sources. The "Domestic and International Transportation of U. S. Foreign Trade 1970" (a joint U. S. Department of Commerce, U. S. Department of Transportation and Department of the Army study) determined the commodity tonnages of U. S. exports by domestic origin and foreign destination, and the commodity tonnages of U. S. imports by foreign origin and domestic destination.

This study considered "liner-type" commodities and excluded major liquid and break bulk commodities such as unmilled grains, iron ores, and petroleum. The San Francisco Bay Region hinterland was determined by listing the state, production area of origin, and the market area of destination, for each two-digit S.I.C. code commodity exported or imported through the San Francisco Customs District. 1/ It should be noted that tonnage data included the entire San Francisco Customs District and was based on a national sample.

The second source for total import and export tonnage to and from twelve major regions of the world was U. S. Department of Commerce data, as presented in the Bank of America's report: "Foreign Trade Through the San Francisco Customs District". Tonnage data for selected years 1961-1968 were developed from the aforementioned report while data for the years 1970 and 1972 were provided by

1/ District includes all of California north of San Luis Obispo, Kern, and San Bernardino Counties, as well as the states of Nevada and Utah.

the U. S. Department of Commerce, under a contract with the Corps. Tonnage was aggregated by country to reflect approximate world trade areas, with crude petroleum excluded from this data. In addition, information on per capita income (constant dollars), national income, and population for these areas was developed. Much of the data on income and population was derived from the "Interoceanic Canal Studies 1970" report prepared by the Atlantic-Pacific Interoceanic Canal Study Commission, augmented by United Nations information.

Domestic waterborne commerce patterns for coastwise receipts, by shipping area, and coastwise shipments, by receiving area, were derived from the Waterborne Commerce Statistics Center's tabulation of movements between ports. This data is for 1970 and 1972 by major commodity tonnages, with individual ports combined into broad coastal zones. Domestic traffic is defined as those commercial movements between points in the United States, Puerto Rico, and the Virgin Islands. Coastwise receipts and coastwise shipments pertain to that domestic traffic occurring on the ocean or the Gulf of Mexico.

III. WEST COAST TRADE INCLUDING RECENT TRADE WITH P. R. C. AND U. S. S. R.

A. WEST COAST REGION

For analytical purposes, the West Coast Region was divided into the following three shipping areas: the San Francisco Bay Region, Southern California, and the Pacific Northwest. The harbors and terminals included in the San Francisco Bay Region were mentioned in the introduction. The Southern California area consists of the harbors of Los Angeles, Long Beach, and San Diego while the Pacific Northwest area includes several Puget Sound harbors in addition to the Columbia River ports. The specific harbors included in the Pacific Northwest are: Bellingham, Anacortes, Everett, Seattle, Tacoma, Olympia, Port Angeles, Port Townsend, and Port Gamble in the Puget Sound area; Portland, Vancouver, Kalama, Longview and Astoria in the Portland area.

In addition to the West Coast Region, the trade of Hawaii and Alaska is briefly examined. The total Hawaiian foreign and domestic coastwise trade in 1972 amounted to about 16,900,000 tons. Of this tonnage, about 4,000,000 tons constituted foreign trade with some 85 percent or 3,400,000 tons being imports of petroleum products. About 11,500,000 tons constituted domestic coastwise trade with 6,600,000 tons being coastwise receipts and 4,900,000 tons coastwise shipments. "Other harbors and waterways", which are not disaggregated into foreign and domestic traffic, amounted to 1,400,000 tons. About one-third of the receipts represented refined petroleum products,

with the remainder composed of various general cargo commodities. Coastwise shipments consisted primarily of sugar, molasses, and agricultural products. Most of the Hawaiian domestic coastwise trade is with the West Coast, and the San Francisco Bay Region ports share significantly in this trade.

Alaska's foreign and domestic coastwise trade for 1972 totaled 20,400,000 tons. Foreign trade accounted for 2.9 million tons, domestic coastwise accounted for 3 million tons, and "other harbors and waterways" were 14.4 million tons. "Other harbors and waterways" amounted to about 71 percent of the total Alaskan tonnage. However, this tonnage was not disaggregated into foreign and domestic categories. Three commodity groups: metallic ores, petroleum products, and lumber and wood products, evenly divided in terms of tonnage, comprised three-fourths of the foreign trade. Major commodities in the coastwise trade consisted of lumber and wood products, petroleum products, and general cargo in the order of 18, 53, and 29 percent of total tonnage respectively. By virtue of its location, the Puget Sound ports, especially Seattle, account for the large share of the Alaskan trade.

B. FOREIGN TRADE MOVEMENTS

Table I presents a summary of foreign imports by region and major harbors.

TABLE I

WEST COAST REGIONS AND MAJOR HARBORS

Foreign Imports
1950 - 1972
(Thousands of Tons)

Region and Major Port	1950	1955	1960	1965	1970	1972
<u>Southern California</u>						
Los Angeles	902	1,731	4,984	7,603	4,811	7,974
Long Beach	396	789	2,480	4,482	5,618	7,649
San Diego	<u>15</u>	<u>56</u>	<u>358</u>	<u>420</u>	<u>209</u>	<u>237</u>
Subtotal	1,313	2,576	7,822	12,505	10,638	15,860
<u>San Francisco Bay Area</u>						
San Francisco	675	860	951	1,075	1,090	1,484
Oakland	119	94	245	384	839	1,198
All other ports ⁽¹⁾	<u>239</u>	<u>2,743</u>	<u>5,605</u>	<u>5,441</u>	<u>4,325</u>	<u>8,708</u>
Subtotal	1,033	3,697	6,801	6,900	6,254	11,390
<u>Pacific Northwest</u>						
Seattle	352	659	975	1,305	2,655	3,367
Tacoma	499	440	578	1,376	2,239	2,040
Other Puget Sound Ports ⁽²⁾	743	888	3,516	1,438	1,439	1,663
Portland ⁽³⁾	<u>108</u>	<u>251</u>	<u>746</u>	<u>1,236</u>	<u>2,542</u>	<u>2,876</u>
Subtotal	1,702	2,238	5,815	5,355	8,875	9,946
<u>TOTAL IMPORTS</u>	<u>4,048</u>	<u>8,511</u>	<u>20,438</u>	<u>24,760</u>	<u>25,767</u>	<u>37,196</u>

(1) Redwood City Harbor, Richmond Harbor, San Pablo Bay and Mare Island Strait, Carquing Strait, Suisun Bay Channel, Lower San Joaquin River, (incl. Port of Stockton), and Port of Sacramento.

(2) Bellingham Harbor, Anacortes Harbor, Everett Harbor, Olympia Harbor, Port Angeles Harbor, Port Townsend Harbor and Port Gambles Harbor.

(3) Columbia and Lower Willamette Rivers, below Vancouver Washington, and Portland Oregon, (includes Portland, Vancouver, Kalama, Longview, and Astoria).

Each region's share of the total West Coast import commerce, in percent of total commerce, and the average annual percentage increase (or decrease) in import tonnage for the periods 1950-1972 and 1965-1972 are presented below.

<u>Region</u>	<u>IMPORTS</u> <u>Percent of total commerce</u>					
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
Southern California	32	30	39	50	41	42
San Francisco Bay	26	44	33	28	24	31
Pacific Northwest	<u>42</u>	<u>26</u>	<u>28</u>	<u>22</u>	<u>35</u>	<u>27</u>
TOTAL	100	100	100	100	100	100

<u>Region</u>	<u>IMPORTS</u> <u>Average annual percent increase (decrease)</u>	
	<u>1950-1972</u>	<u>1965-1972</u>
Southern California	12.0	3.5
San Francisco Bay	11.5	7.4
Pacific Northwest	<u>8.4</u>	<u>9.2</u>
Total West Coast	10.6	6.0

Southern California's share of total West Coast commerce, and to a lesser extent San Francisco Bay's share, have grown at the expense of Pacific Northwest ports. Growth of Total West Coast imports averaged slightly better than 10 percent between 1950-1972 and 6 percent between 1965-1972. Southern California ports had the highest growth rate over the 23-year period, while Pacific Northwest ports had the highest growth rate for the period 1965-1972. The West Coast as a whole has shown steady and consistent growth.

Table II presents a West Coast summary of foreign exports by region and major harbors.

TABLE II

WEST COAST REGIONS AND MAJOR HARBORS
Foreign Exports
1950 - 1972
(Thousands of Tons)

<u>Region and Major Port</u>	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
<u>Southern California</u>						
Los Angeles	1,567	3,155	3,181	2,447	4,909	3,032
Long Beach	1,403	2,277	2,266	4,665	6,909	4,781
San Diego	<u>1</u>	<u>93</u>	<u>134</u>	<u>518</u>	<u>622</u>	<u>253</u>
Subtotal	2,971	5,525	5,581	7,630	12,440	8,066
<u>San Francisco Bay Area</u>						
San Francisco	816	801	534	794	793	650
Oakland	684	771	855	922	1,314	1,112
All other ports ⁽¹⁾	<u>868</u>	<u>1,793</u>	<u>3,324</u>	<u>4,170</u>	<u>4,486</u>	<u>3,385</u>
Subtotal	2,368	3,365	4,713	5,886	6,593	5,147
<u>Pacific Northwest</u>						
Seattle	488	698	1,266	1,246	1,685	1,676
Tacoma	309	817	1,202	1,377	2,794	3,362
Other Puget Sound Ports ⁽²⁾	60	189	272	1,219	4,162	4,127
Portland ⁽³⁾	<u>1,323</u>	<u>2,530</u>	<u>5,114</u>	<u>6,844</u>	<u>10,326</u>	<u>10,728</u>
Subtotal	2,180	4,234	7,854	10,686	18,967	19,893
<u>TOTAL EXPORTS</u>	<u>7,519</u>	<u>13,124</u>	<u>18,148</u>	<u>24,202</u>	<u>38,000</u>	<u>33,106</u>

(1), (2), (3) See footnotes on Table I.

Regional shares of export commerce and percentage growth rates for exports are presented below.

<u>Region</u>	EXPORTS					
	<u>Percent of total commerce</u>					
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
Southern California	40	42	31	32	33	24
San Francisco Bay	31	26	26	24	17	16
Pacific Northwest	29	32	43	44	50	60
TOTAL	100	100	100	100	100	100

<u>Region</u>	EXPORTS	
	<u>Average annual percent increase (decrease)</u>	<u>1965-1972</u>
	<u>1950-1972</u>	
Southern California	4.6	6.0
San Francisco Bay	3.6	(1.9)
Pacific Northwest	10.6	9.3
Total West Coast	6.5	4.6

The Pacific Northwest's share of total West Coast exports gained significantly at the expense of the other two regions. For the Southern California and San Francisco Bay regions, and the West Coast as a whole, commerce peaked in 1970 and declined in 1972, while the Pacific Northwest ports experienced greater commerce in 1972 than in 1970. Growth of exports averaged 6.5 percent for the long run and 4.6 percent for the short run. The Pacific Northwest ports had the greatest growth rate in both the long and short-run periods, while the San Francisco Bay Region had the lowest growth rate.

Table III shows historical waterborne commerce movements for the San Francisco Bay Region, with the Bay Region divided into two subareas: 1) the San Francisco Bay Ports and 2) the Delta Ports.

Tables III through VI, XIV, and XV do not include the following commodities: crude petroleum; sand, gravel, and crushed rock; fresh fish and other marine products; and military controlled cargo. The average annual

TABLE III

SAN FRANCISCO BAY AREA IN-DEPTH STUDY
HISTORIC WATERBORNE COMMERCE MOVEMENTS -1/

(Thousands of Short Tons)

STUDY AREA	Y E A R										% AVERAGE ANNUAL INCREASE 1950-1972
	1950	1955	1960	1962	1964	1965	1966	1968	1970	1972	
San Francisco Bay Ports											
IMPORTS	1,038.3	1,193.3	2,375.0	2,767.9	3,238.4	3,295.1	2,944.0	2,804.6	2,791.8	3,455.3	5.6
EXPORTS	1,495.5	2,748.1	2,954.6	2,993.4	3,836.0	3,765.5	3,699.4	3,865.8	4,347.7	2,996.2	3.2
RECEIPTS	4,672.9	5,068.1	6,003.0	5,214.2	5,635.2	6,760.0	7,681.6	7,436.6	4,926.2	5,843.8	1.0
SHIPMENTS	9,520.7	11,152.2	8,576.2	7,857.7	6,831.3	7,312.4	7,340.2	7,574.2	9,801.9	10,427.3	0.4
TOTAL	16,727.4	20,161.7	19,908.8	18,833.2	19,540.9	21,133.0	21,665.2	21,681.2	21,867.6	22,722.6	1.4
Delta Ports											
IMPORTS	3.3	70.3	103.4	121.3	277.9	227.3	227.0	182.1	63.9	420.5	24.6
EXPORTS	199.7	580.1	1,642.1	1,677.5	1,821.4	1,996.7	1,781.9	1,947.9	2,185.4	1,750.0	10.4
RECEIPTS	21.1	35.6	163.7	130.0	177.6	169.8	224.4	116.2	166.7	729.1	17.5
SHIPMENTS	177.3	337.1	350.3	186.9	185.9	74.2	196.6	209.4	157.0	955.9	7.9
TOTAL	401.4	1,023.1	2,259.5	2,115.7	2,462.8	2,468.0	2,429.9	2,455.6	2,573.0	3,855.5	10.8
TOTAL San Francisco Bay Region											
IMPORTS	1,041.6	1,263.6	2,478.4	2,889.2	3,516.3	3,522.4	3,171.0	2,986.7	2,855.7	3,875.8	6.1
EXPORTS	1,695.2	3,328.2	4,596.7	4,670.9	5,657.4	5,762.2	5,481.3	5,813.7	6,533.1	4,746.2	4.8
RECEIPTS	4,694.0	5,103.7	6,166.7	5,344.2	5,812.8	6,929.8	7,906.0	7,552.8	5,092.9	6,572.9	.5
SHIPMENTS	9,698.0	11,489.3	8,926.5	8,044.6	7,017.2	7,386.6	7,536.8	7,783.6	9,958.9	11,383.2	0.7
TOTAL	17,128.8	21,184.8	22,166.3	20,948.9	22,003.7	23,601.0	24,095.1	24,136.8	24,440.6	26,578.1	2.0

1/ Tonnages do not reflect the following commodities: crude petroleum; sand, gravel, and crushed rocks; fresh fish and other marine products; and military controlled cargo.

increase in import tonnage from 1950-1972 for the Delta was 24.6 percent while San Francisco showed a 5.6 increase. Export tonnage increased 10.4 and 3.2 percent respectively.

The 1972 commerce movements by commodity for San Francisco Bay Ports, Delta Ports, and the San Francisco Bay Region are shown in Tables IV through VI. Commodities accounting for the major portion of import tonnage for San Francisco were primary metals, petroleum products, food & tobacco, and farm products. Export tonnage for San Francisco was primarily composed of food & tobacco, waste & scrap, non-metallic minerals & coal, and primary metals. Non-metallic minerals & coal, pulp & paper products, and food & tobacco products comprise the major share of Delta imports while lumber & furniture, primary metal products, farm products, and food & tobacco products accounted for most of the export tonnage.

An analysis was made to determine the trade area for commodities moving through the Bay Region ports. Tables VII and VIII indicate the pattern of import and export flows for selected commodities moved through the San Francisco Customs District in 1970. Almost 87 percent of the imported commodities were destined for the California market area, with about 68 percent destined for the San Francisco-Oakland markets. Table VIII shows that 88 percent of the exported commodities originated in California. Thirty-two percent of this tonnage originated in the San Francisco-Oakland production area, which also includes Vallejo-Napa and San Jose.

TABLE IV

SAN FRANCISCO BAY AREA IN-DEPTH STUDY
1972 WATERBORNE COMMERCE MOVEMENTS
San Francisco Bay Ports

(Thousands of Short Tons)

CODE	COMMOIDTY	EXPORTS	IMPORTS	RECEIPTS	SHIPMENTS	TOTAL
01	Farm Products	241.6	288.4	49.0	94.8	673.8
08	Forest Products	.3	7.5	-	.4	8.2
10	Metallic Ores	31.5	28.1	-	.2	59.8
11 & 14	Non-metallic Minerals & Coal	457.6	266.4	.4	5.6	730.0
20 & 21	Food & Tobacco Products	623.2	513.6	1,292.7	349.1	2,778.6
22 & 23	Textiles & Apparel Products	15.6	45.8	2.4	17.0	80.8
24 & 25	Lumber & Furniture Products	50.3	64.6	19.8	46.4	181.1
26 & 27	Pulp, Paper & Printed Matter	21.5	271.9	7.8	52.8	354.0
28	Chemical & Allied Products	210.5	68.2	321.7	84.5	684.9
29	Petroleum Products	236.0	574.1	3,766.1	9,189.7	13,765.9
30	Rubber & Plastic Products	4.6	23.2	1.4	8.1	37.3
31	Leather Products	3.1	18.8	3.3	11.0	36.2
32	Stone, Clay, Glass Products	12.1	53.9	52.3	65.7	184.0
33	Primary Metal Products	380.8	795.2	173.3	38.3	1,387.6
34	Fabricated Metal Products	9.6	73.1	39.0	19.0	140.7
35	Machinery, Except Electrical	72.9	92.0	4.4	13.9	183.2
36	Electrical Machinery	22.3	57.4	4.5	22.9	107.1
37	Transportation Equipment	26.9	166.3	16.0	40.7	249.9
40	Waste, Scrap Materials	554.0	5.7	4.6	1.0	565.3
	Other <u>1/</u>	21.8	41.1	85.1	366.2	514.2
	TOTAL	2,996.2	3,455.3	5,843.8	10,427.3	22,722.6

1/ Commodities included in this group are ordnance and accessories (19); instruments, photographic, etc. (38); miscellaneous manufactured products (39); and special items (41).

TABLE V

SAN FRANCISCO BAY AREA IN-DEPTH STUDY
1972 WATERBORNE COMMERCE MOVEMENTS
Delta Ports

(Thousands of Short Tons)

CODE	COMMODITY	EXPORTS	IMPORTS	RECEIPTS	SHIPMENTS	TOTAL
01	Farm Products	260.3	2.2	-	114.3	376.8
10	Metallic Ores	-	23.5	-	-	23.5
11 & 14	Non-metallic Minerals & Coal	88.8	173.3	146.8	-	408.9
20 & 21	Food & Tobacco Products	186.9	86.0	17.6	33.1	323.6
22 & 23	Textiles & Apparel Products	.9	.4	-	-	1.3
24 & 25	Lumber & Furniture Products	619.3	.5	-	-	619.8
26 & 27	Pulp, Paper & Printed Matter	.1	92.1	-	-	92.2
28	Chemicals & Allied Products	69.6	32.6	84.9	40.6	227.7
29	Petroleum Products	-	-	308.9	767.8	1,076.7
30	Rubber & Plastic Products	.1	.2	-	-	.3
32	Stone, Clay, Glass Products	.4	1.3	-	-	1.7
33	Primary Metal Products	448.2	3.6	169.3	-	621.1
34	Fabricated Metal Products	.1	.6	-	-	.7
35	Machinery, Except Electrical	.8	1.9	-	-	2.7
36	Electrical Machinery	-	.5	.8	-	1.3
37	Transportation Equipment	-	1.1	.8	.1	2.0
40	Waste, Scrap Materials	72.2	-	-	-	72.2
	Other ^{1/}	2.3	.7	-	-	3.0
	TOTAL	1,750.0	420.5	729.1	955.9	3,855.5

^{1/} Commodities included in this category are Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Miscellaneous manufactured products (39); and special items (41).

TABLE VI

SAN FRANCISCO BAY AREA IN-DEPTH STUDY
1972 WATERBORNE COMMERCE MOVEMENTS
TOTAL SAN FRANCISCO BAY REGION

(Thousands of Short Tons)

CODE	COMMODITY	EXPORTS	IMPORTS	RECEIPTS	SHIPMENTS	TOTAL
01	Farm Products	501.9	290.6	49.0	209.1	1,050.6
08	Forest Products	.3	7.5	-	.4	8.2
10	Metallic Ores	31.5	51.6	-	.2	83.3
11 & 14	Non-metallic Minerals & Coal	546.4	439.7	147.2	5.6	1,138.9
20 & 21	Food & Tobacco Products	810.1	599.6	1,310.3	382.2	3,102.2
22 & 23	Textiles & Apparel Products	16.5	46.2	2.4	17.0	82.1
24 & 25	Lumber & Furniture Products	669.6	65.1	19.8	46.4	800.9
26 & 27	Pulp, Paper & Printed Matter	21.6	364.0	7.8	52.8	446.2
28	Chemicals & Allied Products	280.1	100.8	406.6	125.1	912.6
29	Petroleum Products	236.0	574.1	4,075.0	9,957.5	14,842.6
30	Rubber & Plastic Products	4.7	23.4	1.4	8.1	37.6
31	Leather Products	3.1	18.8	3.3	11.0	36.2
32	Stone, Clay, Glass Products	12.5	55.2	52.3	65.7	185.7
33	Primary Metal Products	829.0	798.8	342.6	38.3	2,008.7
34	Fabricated Metal Products	9.7	73.7	39.0	19.0	141.4
35	Machinery, Except Electrical	73.7	93.9	4.4	13.9	185.9
36	Electrical Machinery	22.3	57.9	5.3	22.9	108.4
37	Transportation Equipment	26.9	167.4	16.8	40.8	251.9
40	Waste, Scrap Materials	626.2	5.7	4.6	1.0	637.5
	Other ^{1/}	24.1	41.8	85.1	366.2	517.2
	TOTAL	4,746.2	3,875.8	6,572.9	11,383.2	26,578.1

^{1/} Commodities included in this category are Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Miscellaneous manufactured products (39); and Special Items (41).

TABLE VII
1970 DESTINATION OF SELECTED COMMODITIES IMPORTED THROUGH THE SAN FRANCISCO CUSTOMS DISTRICT
(Thousands of Short Tons)

REGION	FOOD & TOBACCO PROD	TEXTILE & APPAREL	LUMBER FURNI- TURE	PULP & PAPER	CHEMI- CALS	PETRL PROD	RUBBER 1/	STONE CLAY GLASS	PRIMARY METALS	FABRI- CATED METALS	MACH	TRANS EQUIP	INSTS & MISC	TOTAL	% OF TOTAL TONS
New England	1	—	—	—	—	—	—	—	—	—	1	—	—	2	.1
Massachusetts	1	—	—	—	—	—	—	—	—	—	—	—	—	1	
Connecticut	—	—	—	—	—	—	—	—	—	—	1	—	—	1	
Middle Atlantic	2	6	3	—	6	—	9	4	—	3	18	1	4	56	4.0
New York	—	6	3	—	—	—	3	4	—	3	12	—	4	35	
Pennsylvania	—	—	—	—	3	—	3	—	—	—	3	—	—	9	
New Jersey	2	—	—	—	3	—	3	—	—	—	3	1	—	12	
East N. Central	19	4	—	—	3	—	—	6	4	—	17	1	6	60	4.3
Ohio	10	—	—	—	—	—	—	—	—	—	3	—	—	13	
Michigan	—	—	—	—	—	—	—	3	4	—	—	—	—	7	
Illinois	9	4	—	—	3	—	—	3	—	—	14	1	6	40	
West N. Central	5	3	—	—	—	—	—	—	—	1	9	—	3	21	1.5
Minnesota	—	—	—	—	—	—	—	—	—	—	3	—	—	3	
Missouri	2	—	—	—	—	—	—	—	—	1	3	—	3	9	
Kansas	3	3	—	—	—	—	—	—	—	—	3	—	—	9	
South Atlantic	—	—	—	—	3	—	—	—	—	—	—	4	—	7	.5
Virginia	—	—	—	—	—	—	—	—	—	—	—	1	—	1	
N. Carolina	—	—	—	—	3	—	—	—	—	—	—	3	—	6	
East S. Central	—	—	—	—	—	—	3	—	—	3	6	—	3	15	1.1
Kentucky	—	—	—	—	—	—	—	—	—	—	—	—	3	3	
Tennessee	—	—	—	—	—	—	—	—	—	—	6	—	—	6	
Alabama	—	—	—	—	—	—	—	—	—	3	—	—	—	3	
Mississippi	—	—	—	—	—	—	3	—	—	—	—	—	—	3	
West S. Central	—	—	—	—	3	—	—	—	—	—	—	—	—	3	.2
Louisiana	—	—	—	—	3	—	—	—	—	—	—	—	—	3	
Mountain	3	—	3	2	—	—	2 1/	—	—	—	3	4	3	17	1.2
New Mexico	—	—	3	—	—	—	—	—	—	—	—	—	—	3	
Nevada	3	—	—	—	—	—	2	—	—	—	3	—	—	8	
Colorado	—	—	—	2	—	—	—	—	—	—	—	1	3	6	
Pacific (Excl CA)	—	—	—	—	—	—	—	—	3	3	—	1	—	7	.5
Oregon	—	—	—	—	—	—	—	—	3	—	—	1	—	4	
Washington	—	—	—	—	—	—	—	—	—	3	—	—	—	3	
California	245	9	28	201	45	55	9	29	407	24	35	115	9	1,211	86.6
Stockton-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sacramento	29	9	—	4	—	—	—	—	35	—	9	—	—	86	6.2
Fresno	3	—	—	—	—	—	—	—	6	3	—	—	—	12	.9
San Diego	—	—	3	—	—	—	—	—	—	—	—	—	—	3	.2
SF - Oakland	180	—	21	197	16	55	4	29	321	18	20	86	3	950	67.9
LA - Long Beach	1	—	—	—	—	—	5	—	21	3	3	6	3	42	3.0
Rest of State	32	—	4	—	29	—	—	—	24	—	3	23	3	118	8.4
TOTAL	275	22	34	203	60	55	23	39	414	34	89	123	28	1,399	100.0

1/ Includes 2,000 tons of leather products (31) from Nevada.

TABLE VIII
1970 ORIGIN OF SELECTED COMMODITIES EXPORTED THROUGH THE SAN FRANCISCO CUSTOMS DISTRICT

(Thousands of Short Tons)

	FOOD & TOBACCO PROD	LUMBER FURNI- TURE	PULP & PAPER	CHEMI- CAL	PETRL PROD	STONE CLAY GLASS	PRIMARY METALS	FABRI- CATED METALS	MACH (non- elec)	MACH (elec)	TRANS EQUIP	INSTS & MISC	TOTAL	% OF TOTAL TONS
Middle Atlantic	—	—	—	4	—	—	—	—	—	—	—	—	4	.1
New Jersey	—	—	—	4	—	—	—	—	—	—	—	—	4	
East N. Central	18	8	4	11	—	—	—	8	87	16	4	16	172	5.1
Ohio	4	4	—	—	—	—	—	—	4	4	—	4	20	
Michigan	—	4	—	3	—	—	—	—	4	—	4	4	19	
Illinois	12	—	4	4	—	—	—	8	63	8	—	—	99	
Indiana	—	—	—	—	—	—	—	—	4	—	—	—	4	
Wisconsin	2	—	—	4	—	—	—	—	12	4	—	8	30	
West N. Central	32	8	—	4	—	—	—	—	8	—	—	—	52	1.5
Minnesota	15	—	—	—	—	—	—	—	4	—	—	—	19	
Nebraska	5	—	—	—	—	—	—	—	—	—	—	—	5	
Iowa	8	4	—	—	—	—	—	—	4	—	—	—	16	
Kansas	4	4	—	—	—	—	—	—	—	—	—	—	8	
Missouri	—	—	—	4	—	—	—	—	—	—	—	—	4	
South Atlantic	3	—	—	—	—	—	—	—	—	4	—	—	7	.2
Virginia	3	—	—	—	—	—	—	—	—	—	—	—	3	
N. Carolina	—	—	—	—	—	—	—	—	—	4	—	—	4	
East S. Central	4	—	—	—	—	—	—	—	—	4	—	—	8	.2
Alabama	—	—	—	—	—	—	—	—	—	4	—	—	4	
Mississippi	4	—	—	—	—	—	—	—	—	—	—	—	4	
West S. Central	15	—	—	—	4	—	—	—	4	—	—	—	23	.7
Arkansas	4	—	—	—	4	—	—	—	—	—	—	—	8	
Texas	11	—	—	—	—	—	—	—	4	—	—	—	15	
Mountain	19	—	—	35	—	—	—	—	—	—	—	—	54	1.6
Colorado	15	—	—	—	—	—	—	—	—	—	—	—	15	
Utah	4	—	—	35	—	—	—	—	—	—	—	—	39	
Pacific (Excl CA)	8	65	8	—	—	—	—	—	—	—	—	—	81	2.4
Washington	4	14	4	—	—	—	—	—	—	—	—	—	22	
Oregon	—	51	4	—	—	—	—	—	—	—	—	—	55	
Hawaii	4	—	—	—	—	—	—	—	—	—	—	—	4	
California	648	810	224	112	1,024	71	72	4	12	4	4	—	2,985	88.2
Stockton-	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sacramento	109	4	4	4	—	—	—	—	—	—	—	—	121	3.6
Fresno	132	—	—	—	225	—	—	—	8	—	—	—	365	10.8
San Diego	4	—	—	—	—	—	—	—	—	—	—	—	4	.1
SF - Oakland	191	61	8	84	646	4	72	4	4	—	2	—	1,076	31.8
LA - Long Beach	12	—	—	8	—	—	—	—	—	4	—	—	24	.7
Rest of State	200	745	212	16	153	67	—	—	—	—	2	—	1,395	41.2
TOTAL	747	891	236	166	1,028	71	72	12	111	28	8	16	3,386	100.0

Tables IX and X present foreign trade patterns of the San Francisco Customs District by major world areas for selected years 1961-1972. Japanese and Asian trade are a significant part of the total foreign trade for the San Francisco Customs District. This trade in 1972 amounted to almost 42 percent for imports and 73 percent for exports. In 1970, which may be a more representative year due to a Japanese Seamen's strike in 1972, Japanese and Asian imports were 47 percent and exports 74 percent of the Customs District's respective totals. While the combined share for Japanese and Asian trade was similar in both 1970 and 1972, Japan alone, accounted for 26 percent of the imports in 1970 versus 22 percent in 1972. A similar decrease in relative importance is noted for exports, where Japan accounted for 59 percent in 1970 and 50 percent in 1972.

C. DOMESTIC TRADE MOVEMENTS

Table XI summarizes coastwise receipts by the West Coast regions and major harbors. The region's share of the total West Coast commerce and the average annual percent increase (decrease) in tonnage for the time periods 1950-1972 and 1965-1972 are presented on page 29.

TABLE IX

SAN FRANCISCO CUSTOMS DISTRICT FOREIGN TRADE BY MAJOR WORLD AREA
IMPORTS ^{1/}
(Millions of Pounds)

AREA	1961	1962	1964	1965	1966	1968	1970	1972	% OF TOTAL 1961	% OF TOTAL 1965	% OF TOTAL 1972
North America	603.6	822.5	1,360.5	1,363.1	1,262.6	817.4	606.8	673.4	11.2	19.7	8.7
Central America	617.7	691.7	902.3	818.6	807.5	786.5	756.3	976.0	11.5	11.8	12.5
South America	895.4	1,171.8	1,071.7	913.6	722.5	530.5	614.3	583.1	16.6	13.2	7.5
West Indies	1,107.3	1,316.3	1,073.7	908.3	1,036.6	752.5	322.4	882.4	20.6	13.1	11.4
Asia (Less Japan)	706.3	796.8	643.7	748.8	726.7	816.6	1,202.5	1,524.1	13.1	10.8	19.6
Japan	679.5	528.6	740.4	909.3	1,005.1	1,282.6	1,599.3	1,699.0	12.6	13.1	21.9
Middle East	89.7	113.2	639.1	574.0	14.3	34.0	1.6	250.3	1.7	8.3	3.2
Africa	102.7	93.5	162.4	157.9	157.8	146.6	126.1	151.3	1.9	2.3	1.9
W. Europe	403.0	440.7	416.6	376.9	419.4	523.7	587.5	773.8	7.5	5.5	10.0
E. Europe	1.4	1.8	22.3	3.6	21.6	6.1	14.6	16.2	-	.1	.2
Oceania	174.8	222.1	205.3	148.6	224.7	224.7	236.8	244.3	3.3	2.1	3.1
TOTAL	5,381.4	6,199.0	7,238.0	6,922.7	6,398.8	5,921.2	6,068.2	7,773.9	100.0	100.0	100.0

^{1/} Excludes crude petroleum.

TABLE X

SAN FRANCISCO CUSTOMS DISTRICT FOREIGN TRADE BY MAJOR WORLD AREA
EXPORTS
(Millions of Pounds)

AREA	1961	1962	1964	1965	1966	1968	1970	1972	% OF TOTAL 1961	% OF TOTAL 1965	% OF TOTAL 1972
North America	476.3	614.7	509.5	389.2	535.6	435.1	479.5	805.2	5.1	3.9	7.6
Central America	42.1	36.4	145.6	209.2	148.9	182.2	223.3	89.2	5.5	2.1	.8
South America	148.9	184.7	207.5	194.0	207.0	217.0	191.0	193.5	1.6	2.0	1.8
West Indies	10.8	12.5	12.4	9.6	15.1	17.9	126.4	8.3	.1	.1	.1
Asia (Less Japan)	1,308.5	1,341.2	1,542.6	1,631.6	1,821.8	2,780.0	2,176.8	2,458.1	13.9	16.5	23.2
Japan	5,700.1	4,968.4	7,001.4	5,996.2	6,710.4	8,350.0	8,569.6	5,254.7	60.4	60.5	49.5
Middle East	75.8	47.6	28.6	29.3	29.9	27.4	33.5	58.8	.8	.3	.6
Africa	182.1	90.9	89.1	43.4	122.1	34.9	54.1	60.3	1.9	.4	.6
W. Europe	1,276.4	1,867.2	1,791.8	1,167.4	1,463.5	1,216.8	2,363.6	1,447.9	13.5	11.8	13.6
E. Europe	8.3	57.0	6.1	5.4	15.9	7.6	11.8	8.6	.1	.1	.1
Oceania	202.8	251.9	223.4	230.2	274.6	260.4	283.9	220.0	2.1	2.3	2.1
TOTAL	9,432.1	9,472.5	11,558.0	9,905.5	11,344.8	13,529.3	14,513.5	10,604.6	100.0	100.0	100.0

TABLE XI

WEST COAST REGIONS AND MAJOR HARBORS
Coastwise Receipts
1950 - 1972
(Thousands of Tons)

<u>Region and Major Port</u>	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
<u>Southern California</u>						
Los Angeles	4,728	6,013	5,336	4,440	5,923	5,454
Long Beach	935	789	957	1,246	5,222	6,001
San Diego	<u>940</u>	<u>1,511</u>	<u>1,522</u>	<u>554</u>	<u>893</u>	<u>985</u>
Subtotal	6,603	8,313	7,815	6,240	12,038	12,440
<u>San Francisco Bay Area</u>						
San Francisco	443	449	598	260	12	16
Oakland	832	928	1,075	1,168	579	866
All other ports (1)	<u>9,890</u>	<u>10,294</u>	<u>10,334</u>	<u>10,653</u>	<u>16,196</u>	<u>15,564</u>
Subtotal	11,165	11,671	12,007	12,081	16,787	16,446
<u>Pacific Northwest</u>						
Seattle	5,295	5,125	3,525	3,129	2,174	1,722
Tacoma	822	776	677	147	399	344
Other Puget Sound Ports (2)	379	353	1,507	796	556	316
Portland (3)	<u>6,407</u>	<u>6,993</u>	<u>5,857</u>	<u>6,411</u>	<u>5,187</u>	<u>5,273</u>
Subtotal	12,903	13,247	11,566	10,483	8,316	7,655
<u>TOTAL RECEIPTS</u>	<u>20,671</u>	<u>33,231</u>	<u>31,388</u>	<u>28,804</u>	<u>37,141</u>	<u>36,541</u>

(1). (2), (3) See footnotes on Table I.

<u>Region</u>	RECEIPTS					
	Percent of total commerce					
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
Southern California	22	25	25	22	32	34
San Francisco Bay	36	35	38	42	45	45
Pacific Northwest	42	40	37	36	23	21
TOTAL	100	100	100	100	100	100

<u>Region</u>	RECEIPTS	
	Average annual percent increase (decrease)	
	<u>1950-1972</u>	<u>1965-1972</u>
Southern California	2.9	3.2
San Francisco Bay	1.8	4.5
Pacific Northwest	(2.3)	(4.4)
Total West Coast	2.6	3.5

Ports within the San Francisco Bay Region and Southern California increased their share of total West Coast commerce relative to Pacific Northwest ports. Growth of coastwise receipts averaged 2.6 percent for the 1950-1972 period and slightly higher, 3.5 percent, for the 1965-1972 period. Strong growth by the San Francisco Bay Region ports from 1965-1972 offset the decline of Pacific Northwest ports.

Domestic coastwise shipment tonnages are presented in Table XII and percentage figures are shown below.

<u>Region</u>	SHIPMENTS					
	Percent of total commerce					
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
Southern California	54	43	43	36	40	34
San Francisco Bay	36	47	40	37	42	50
Pacific Northwest	10	10	17	27	18	16
TOTAL	100	100	100	100	100	100

<u>Region</u>	SHIPMENTS	
	Average annual percent increase (decrease)	
	<u>1950-1972</u>	<u>1965-1972</u>
Southern California	(2.7)	(0.1)
San Francisco Bay	0.9	5.0
Pacific Northwest	1.3	(7.2)
Total West Coast	(0.6)	0.5

TABLE XII

WEST COAST REGIONS AND MAJOR HARBORS
Coastwise Shipments
1950 - 1972
(Thousands of Tons)

<u>Region and Major Port</u>	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
<u>Southern California</u>						
Los Angeles	12,085	7,716	8,306	5,921	6,009	6,112
Long Beach	2,270	2,741	3,211	2,014	3,286	1,790
San Diego	<u>27</u>	<u>neg</u>	<u>9</u>	<u>17</u>	<u>12</u>	<u>0</u>
Subtotal	14,382	10,457	11,526	7,952	9,307	7,902
<u>San Francisco Bay Area</u>						
San Francisco	452	398	317	231	25	53
Oakland	513	751	603	924	1,276	1,418
All other ports ⁽¹⁾	<u>8,401</u>	<u>10,356</u>	<u>9,554</u>	<u>6,965</u>	<u>8,707</u>	<u>9,955</u>
Subtotal	9,366	11,505	10,474	8,120	10,008	11,426
<u>Pacific Northwest</u>						
Seattle	733	649	751	923	875	1,369
Tacoma	325	156	254	103	225	128
Other Puget Sound Ports ⁽²⁾	378	637	2,761	4,137	2,392	1,541
Portland ⁽³⁾	<u>1,224</u>	<u>1,086</u>	<u>770</u>	<u>864</u>	<u>723</u>	<u>532</u>
Subtotal	2,660	2,528	4,536	6,027	4,215	3,570
<u>TOTAL SHIPMENTS</u>	<u>26,408</u>	<u>24,490</u>	<u>26,536</u>	<u>22,099</u>	<u>23,530</u>	<u>22,898</u>

(1), (2), (3) See footnotes on Table I.

Coastwise shipment tonnage was very erratic, with an overall decline in tonnage for the long run and a slight increase in tonnage for the short run. While Southern California tonnage declined, San Francisco Bay and the Pacific Northwest harbors experienced an increase in tonnage for the long run. The 5 percent average growth for San Francisco offset the short run declines of Southern California and Pacific Northwest.

Table XIII is a summary of the total foreign and domestic coastwise commerce by regions and major harbors. Following are the percentages with respect to Table XIII.

<u>Region</u>	<u>Percent of total commerce</u>					
	<u>1950</u>	<u>1955</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>1972</u>
Southern California	37	34	34	34	36	34
San Francisco Bay	35	38	35	33	32	34
Pacific Northwest	<u>28</u>	<u>28</u>	<u>31</u>	<u>33</u>	<u>32</u>	<u>32</u>
TOTAL	100	100	100	100	100	100

<u>Region</u>	<u>Average annual percent increase (decrease)</u>	
	<u>1950-1972</u>	<u>1965-1972</u>
Southern California	2.6	3.7
San Francisco Bay	2.8	4.3
Pacific Northwest	<u>3.5</u>	<u>3.4</u>
Total West Coast	2.9	3.8

The San Francisco Bay Region maintained its share of total commerce, while the Southern California share decreased, and the Pacific Northwest share increased over the long run. Overall trends, however, indicate consistent long and short-run growth. Southern

TABLE XIII

WEST COAST REGIONS AND MAJOR HARBORS
Summary, Foreign and Domestic Coastwise Waterborne Commerce
1950 - 1972
(Thousands of Tons)

Region and Major Port	1950	1955	1960	1965	1970	1972
<u>Southern California</u>						
Los Angeles	19,282	18,615	21,807	20,411	21,652	22,572
Long Beach	5,004	6,596	8,914	12,407	21,035	20,221
San Diego	<u>983</u>	<u>1,660</u>	<u>2,023</u>	<u>1,509</u>	<u>1,736</u>	<u>1,475</u>
Subtotal	25,269	26,871	32,744	34,327	44,423	44,268
<u>San Francisco Bay Area</u>						
San Francisco	2,386	2,508	2,400	2,360	1,920	2,203
Oakland	2,148	2,544	2,778	3,398	4,008	4,594
All other ports ⁽¹⁾	<u>19,398</u>	<u>25,186</u>	<u>28,817</u>	<u>27,229</u>	<u>33,714</u>	<u>37,612</u>
Subtotal	23,932	30,238	33,995	32,987	39,642	44,409
<u>Pacific Northwest</u>						
Seattle	6,868	7,131	6,517	6,603	7,389	8,134
Tacoma	1,955	2,189	2,711	3,003	5,657	5,874
Other Puget Sound Ports ⁽²⁾	1,560	2,067	8,056	7,590	8,549	7,647
Portland ⁽³⁾	<u>9,062</u>	<u>10,860</u>	<u>12,487</u>	<u>15,355</u>	<u>18,778</u>	<u>19,409</u>
Subtotal	19,445	22,247	29,771	32,551	40,373	41,064
<u>TOTAL</u>	<u>68,646</u>	<u>79,356</u>	<u>96,510</u>	<u>99,865</u>	<u>124,438</u>	<u>129,741</u>

(1), (2), (3) See footnotes on Table I.

California and Pacific Northwest growth between 1970 and 1972 leveled off somewhat. Total West Coast commerce increased about 3 percent per year for the long run, with Pacific Northwest leading, followed by San Francisco. The short-run period for total West Coast commerce showed a 3.8 percent average growth, with San Francisco leading, followed by Southern California.

Table III (p. 18) shows slight average annual increases of 1.0 and 0.4 percent respectively for coastwise receipts and shipments in the San Francisco Bay Ports between 1950 and 1972. The Delta has shown strong growth in coastwise receipts (17.5 percent) and shipments (7.9 percent) over the same period. Comparison of total tonnage movements between San Francisco ports and the Delta ports shows average annual growth rates of 1.4 percent and 10.8 percent respectively.

Tables IV, V, and VI (pages 20, 21 and 22) show commerce movements by commodity. Food & tobacco and petroleum products, combined, account for about 87 percent of coastwise receipts and 91 percent of coastwise shipments for San Francisco Bay ports. Coastwise receipts for the Delta ports are mainly composed of petroleum products (42 percent), primary metal products (23 percent), and non-metallic minerals & coal (20 percent). Coastwise shipments for the Delta ports are primarily petroleum products (80 percent) and farm products (12 percent).

Tables XIV and XV present San Francisco Bay Region coastwise receipts by shipping area and coastwise shipments by receiving area for 1972. The shipping and receiving areas have been grouped into broad coastal zones. Trade with West Coast ports, including Alaska and Hawaii, constitute about 85 percent and 95 percent of the San Francisco Bay Region's coastwise receipts and shipments, respectively. A substantial portion of both coastwise receipts and shipments involve the movement of petroleum products. By subtracting these petroleum movements from the totals, one can see there is little other coastal waterborne movement between the San Francisco Bay Region and West Coast ports (excluding Hawaii).

TABLE XIV

SAN FRANCISCO BAY DOMESTIC WATERBORNE COMMERCE PATTERNS
COASTWISE RECEIPTS BY SHIPPING AREA 1/
1972
(Thousands of Short Tons)

CODE	COMMODITY GROUP	NEW ENGLAND	N.Y./VA	N.C./MISS 2/	LA/TEX	CA	PACIFIC NORTHWEST 3/	HAWAII	TOTAL	COMMODITY AS % OF TOTAL
01	Farm Products	-	1.2	.8	-	.1	23.4	23.5	49.0	.8
14	Non-metallic Minerals	-	.1	146.8	-	.1	.2	-	147.2	2.2
19	Ordnance & Accessories	-	1.0	-	-	-	-	-	1.0	-
20	Food & Kindred Products	.2	15.4	9.1	-	.4	9.1	1,276.1	1,310.3	20.1
21	Tobacco Products	-	.1	-	-	-	-	-	.1	-
22	Basic Textiles	-	1.1	.5	-	-	.2	.3	2.1	-
23	Apparel	-	.1	.1	-	-	-	-	.2	-
24	Lumber & Wood Products	-	.6	-	-	-	3.4	1.0	5.0	.1
25	Furniture & Fixtures	-	2.3	.4	-	-	-	12.1	14.8	.2
26	Pulp, Paper	.0	2.7	.1	-	.1	4.4	-	7.3	.1
27	Printed Matter	-	.3	-	-	-	-	-	.3	-
28	Chemicals & Allied Products	-	30.0	15.9	171.6	160.5	20.6	8.0	406.6	6.2
29	Petroleum Products	-	5.7	-	159.7	2630.1	1,242.5	37.0	4,075.0	62.6
30	Rubber & Misc. Plastic Prod.	-	1.2	.1	-	-	-	.1	1.4	-
31	Leather	.5	2.8	-	-	-	-	-	3.3	-
32	Stone, Clay, Glass	-	1.6	.1	-	-	49.8	.8	52.3	.8
33	Primary Metal Products	.2	339.6	.3	-	-	2.4	.1	342.6	5.3
34	Fabricated Metal Products	.1	35.5	.4	-	-	.3	2.7	39.0	.6
35	Non-electric Machinery	-	2.1	.1	-	-	.1	2.1	4.4	.1
36	Electric Machinery	-	2.8	.3	-	.8	.2	1.1	5.2	.1
37	Transportation Equipment	-	.6	5.1	-	-	.2	11.0	16.9	.3
38	Instruments	-	.2	-	-	-	-	-	.2	-
39	Misc. Manufactured Products	-	18.6	.4	-	-	.2	3.5	22.7	.4
40	Waste & Scrap	-	.8	.1	-	-	.1	3.6	4.6	.1
	TOTAL	1.0	466.4	180.6	331.3	2,792.1	1,357.1	1,383.0	6,511.5	100.0
	Percent by Region	-	7.2	2.8	5.1	42.9	20.8	21.2	100.0	-
	TOTAL LESS PETROLEUM	1.0	460.7	180.6	171.6	162.0	114.6	1,346.0	2,436.5	-
	Percent by Region	-	18.9	7.4	7.0	6.7	4.7	55.2	-	-

- 1/ Excludes Internal Bay Traffic
2/ Including Puerto Rico.
3/ Including Alaska.

TABLE XV

SAN FRANCISCO BAY DOMESTIC WATERBORNE COMMERCE PATTERNS
COASTWISE SHIPMENTS BY RECEIVING AREA 1/

1972

(Thousands of Short Tons)

CODE	COMMODITY GROUP	NEW ENGLAND	N.Y./VA	N.C./MISS <u>2/</u>	LA/TEX	CA	PACIFIC NORTHWEST <u>3/</u>	HAWAII	TOTAL	COMMODITY AS % OF TOTAL
01	Farm Products	-	.4	129.4	-	.2	.2	79.0	209.2	1.9
08	Forest Products	-	.3	.1	-	-	-	.1	.5	-
10	Metallic Ores	-	-	-	-	-	-	.2	.2	-
14	Non-metallic Minerals	-	-	2.1	-	-	-	3.6	5.7	.1
19	Ordnance & Accessories	-	2.2	.1	-	-	-	-	2.3	-
20	Food & Kindred Products	-	46.1	59.9	-	.2	24.1	250.2	380.5	3.5
21	Tobacco Products	-	-	-	-	-	-	1.6	1.6	-
22	Basic Textiles	-	6.1	1.4	-	-	-	5.2	12.7	.1
23	Apparel	-	3.1	.7	.3	-	-	.1	4.2	-
24	Lumber & Wood Products	-	.5	5.7	-	-	.4	26.2	32.8	.3
25	Furniture & Fixtures	-	1.5	.8	-	-	.6	10.7	13.6	.1
26	Pulp, Paper	-	.5	4.6	-	-	-	44.0	49.1	.4
27	Printed Matter	-	-	.3	-	-	-	3.4	3.7	-
28	Chemicals & Allied Products	-	14.2	8.9	4.2	38.0	11.2	48.5	125.0	1.1
29	Petroleum Products	-	44.4	1.3	133.2	4,195.5	3,966.6	1,619.0	9,960.0	90.1
30	Rubber & Misc. Plastic Prod.	-	2.0	.3	-	-	.1	5.7	8.1	.1
31	Leather	.1	8.7	2.0	.1	-	-	-	10.9	.1
32	Stone, Clay, Glass	-	.7	.7	-	3.1	29.9	34.3	68.7	.6
33	Primary Metal Products	-	.1	2.8	-	-	-	35.3	38.2	.4
34	Fabricated Metal Products	-	1.0	.4	-	-	.5	17.1	19.0	.2
35	Non-electric Machinery	-	.6	.5	-	-	.7	12.0	13.8	.1
36	Electric Machinery	-	6.5	1.9	-	-	.3	14.2	22.9	.2
37	Transportation Equipment	-	2.8	.8	.3	-	.4	36.5	40.8	.4
38	Instruments	-	.2	-	-	-	-	.3	.5	-
39	Misc. Manufactured Products	-	13.5	3.3	-	-	.9	16.8	34.5	.3
40	Waste & Scrap	-	.1	.1	-	-	.3	.5	1.0	-
	TOTAL	.1	155.5	228.1	138.1	4,237.0	4,036.2	2,264.5	11,059.5	100.0
	Percent by Region	-	1.4	2.1	1.2	38.3	36.5	20.5	100.0	
	TOTAL LESS PETROLEUM	.1	111.1	226.8	4.9	41.5	69.6	645.5	1,099.5	
	Percent by Region	-	10.1	20.6	.5	3.8	6.3	58.7	100.0	

1/ Excludes Internal Bay Traffic.2/ Includes Puerto Rico.3/ Includes Alaska.

D. U. S. TRADE WITH THE P. R. C. AND THE U. S. S. R. 1/

Trade between the United States and the People's Republic of China and between the United States and the U.S.S.R. has grown from an essentially negligible magnitude in the sixties to the billion-dollar range in recent years. Although the total volume of Chinese and Soviet trade is still quite small in relation to total U. S. trade (U. S. \$174.7 billion in 1973), China and the U. S. S. R. represent two of the very few remaining areas in which substantial growth of trade with the U. S. is possible. Moreover, these trading relationships may be especially important for the growth of specific regional economies in the U. S. It is impractical to analyze and project future developments of U. S. - China and U. S. - U. S. S. R. trade based on the historical data, as much of the impetus for the very rapid growth of trade in the past five years came not from conventional demand and supply considerations but from administrative and political decisions on the part of the governments concerned. Political considerations still dominate the trade climate and one or more actions of any of the governments can affect the volume of trade substantially. These actions may include:

- (1) Imposition or removal of export controls on selected commodities: aircraft; computers; electronics; food grains.
- (2) Allocation of export credit.

1/ This section was prepared by Dr. L. Lau in his report, "Projection of U. S. - China and U. S. - U. S. S. R. Trade in 1980" to the Corps of Engineers. Projections presented in this section are not explicitly incorporated into the projections presented in Chapter V. However, the projections of Chapter V do include trade with the P.R.C. and U.S.S.R. to the extent that it is reflected in the historical data of 1970, 1971, and 1972.

(3) Granting or denial of most-favored-nation treatment.

(4) Allocation of import quotas on selected commodities:
iron and steel; petroleum and petroleum products;
textiles.

In addition, the volume of trade from year to year may fluctuate substantially depending on the weather conditions, and the time-phasing of large, one-shot projects. In the intermediate to long run, the degree of commitment of the governments of China and the U. S. S. R. to basic self-sufficiency may place a limit on the possible growth in trade.

Inasmuch as the future trade developments between the U. S. and China and between the U. S. and the U. S. S. R. are subject to much uncertainty, any projection must involve some subjective evaluation of the likely course of events. A mechanical trend extrapolation exercise will not be very useful because the fantastic rates of growth achieved during the initial stage of East-West trade is unlikely to be repeated. In what follows, alternative projections of U. S. trade with China and the U. S. S. R. for 1980 are presented, based on alternative assumptions of the likely future developments. Two sets of projections are distinguished: one set is based on the assumption that the current environment (quotas, tariffs, etc.) will persist until 1980; the other set is based on the assumption that the environment will become "normalized"; that is, both China and the U. S. S. R. will be granted most-favored-nation treatment, export credits will become available, and other discriminatory restrictions will be removed.

1. People's Republic of China

Chinese trade, especially Chinese trade with the non-Communist countries, has been increasing by leaps and bounds since 1960. (See Figure 1). Even allowing for the effect of inflation and devaluation of the U.S. dollar, the real rate of increase is still very substantial.

Chinese imports include principally aircraft, food grains, electronics, fertilizers, plastics, petrochemicals, complete plants, and oil exploration equipment. Chinese exports include principally food stuffs, crude materials, fuels, edible oils (including petroleum and petroleum products), and light manufactures (including textiles) (See Table XVI).

U.S. trade with China resumed in 1971, after an interruption of more than twenty years, with a very small volume--\$5 million. But it grew extremely rapidly so that by 1973 the U.S. became China's second largest trading partner after Japan (See Table XVII).

Lack of available data prevents a detailed analysis of the underlying determinants of possible patterns of U.S.-China trade in 1980. Rather, two alternative projections are made based on two equally crude assumptions --first, that the current trade shares will prevail; and second, that the U.S. will regain its historical trade shares relative to Western Europe and Japan if the trade environment is "normalized."

FIGURE 1

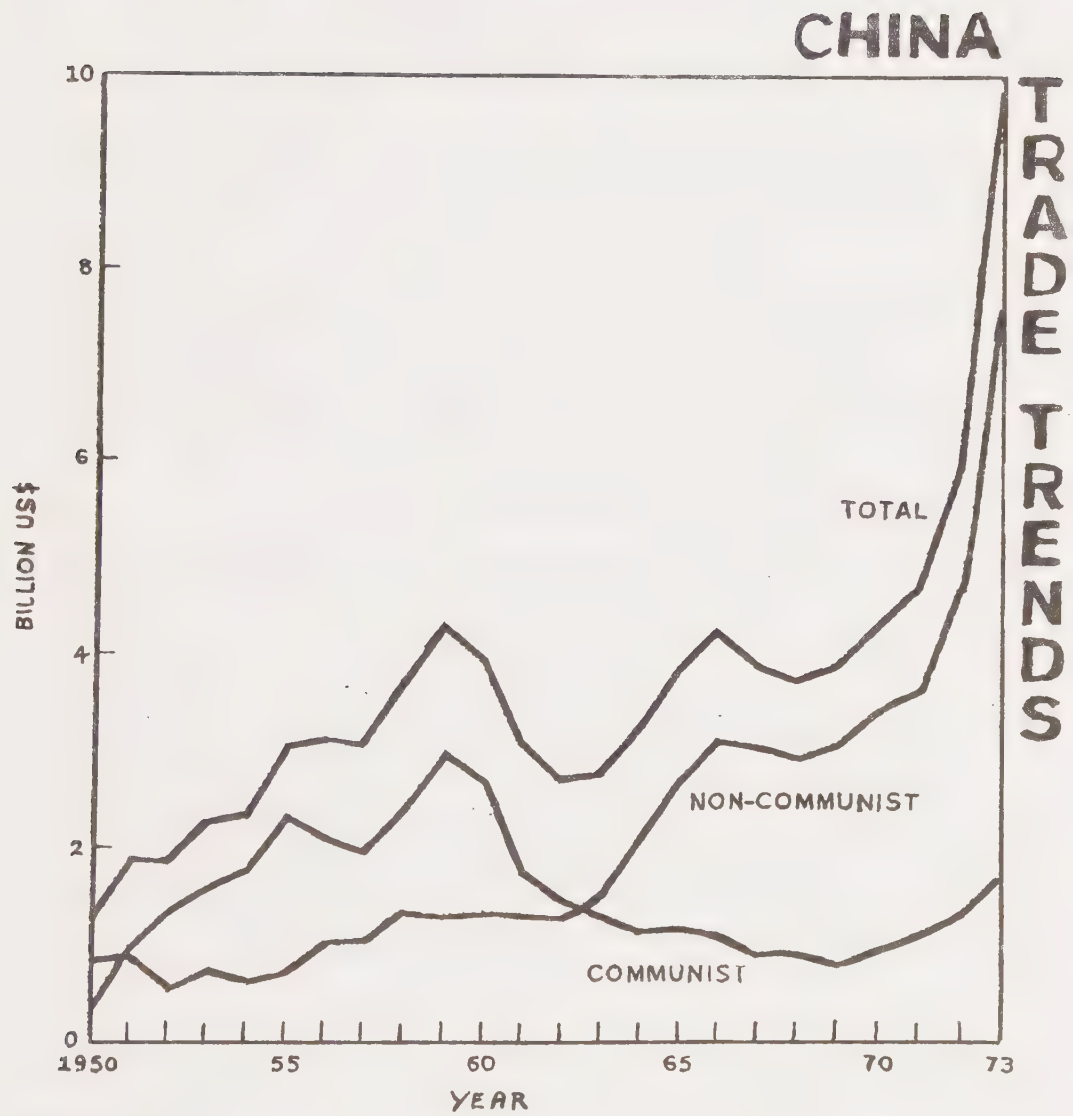


TABLE XVI

Commodity Composition of U.S.-China Trade, 1973
(Percent)

Commodities	Chinese Exports	Chinese Imports
Food and live animals	9.5	59.5
Beverages and tobacco	0.2	0.2
Crude material, inedible, except fuels	23.0	24.9
Mineral fuels, lubricants, related products	0.7	0.0
Animal and vegetable oils, fats	1.2	2.8
Chemicals	13.4	1.1
Manufactured goods classified chiefly by materials	33.1	1.3
Machinery and transport equipment	0.6	10.0
Miscellaneous Manufacturing articles	17.6	0.1
Commodities and transactions NEC	<u>0.6</u>	<u>0.0</u>
TOTAL	100.0	100.0

TABLE XVII

U.S. Share in Chinese Trade

. (million U.S. dollars)

Year	Trade		Exports		Imports	
	Total	U.S.	Total	U.S.	Total	U.S.
1971	4,720	5	2,415	5	2,305	0
1972	5,920	111	3,085	32	2,835	79
1973	9,870	876	4,895	64	4,975	812
1974	13,500	1,200	6,250	100	7,250	1,100

First examine the current trade shares by area or country. (See Table XVIII).

While the import shares of the U. S., Japan, and Western Europe are similar in order of magnitude, the share of Chinese exports to the U. S. is exceptionally low. This is due to many factors, economic as well as political. There is reason to believe that as the trade environment is "normalized" the U. S. export share should approach its historical value in relation to Western Europe and Japan.

Therefore, the historical record of trade shares needs to be examined. Here the data are rather sketchy and the percentages given should be looked upon as order of magnitude estimates only. One point is apparent--that is, the U. S., Japan, and Western Europe have approximately the same trade shares historically. (See Table XIX)

In order to make a projection based on shares, a basic growth rate should be adopted, preferably for a period which is relatively free of inflation or major changes of exchange rates. Between 1960 and 1970, both Chinese exports to and imports from non-Communist countries have increased at a compounded annual rate of 9.6 percent. The rate of 9.6 percent is probably more representative of the long-term growth rate of the real volume of exports and imports because these years are relatively free of inflation and devaluations. Using this rate and 1973 as a base year, one may project Chinese exports to and imports from the United States in 1980 to be 120 million U. S. dollars and 1,550 million dollars respectively. ^{2/}

^{2/} The 1973 imports figures are used for projection purposes because the 1974 figures are still preliminary estimates.

TABLE XVIII

Distribution of Chinese Trade
by Area/Country, 1973

(percent)

Country/Area	Total	Exports	Imports
United States	8.9	1.3	16.3
Australia	2.5	1.8	3.2
Japan	20.5	19.0	22.0
Western Europe	17.1	13.6	20.6
Canada	4.1	1.1	7.2
Less Developed Countries	21.0	25.9	16.2
Hong Kong and Macao	8.5	16.9	0.0
Communist Countries	<u>17.2</u>	<u>20.3</u>	<u>14.2</u>
All Countries ¹	99.8	99.9	99.7

Source: Central Intelligence Agency, People's Republic of China: International Trade Handbook, Research Aid A (ER) 74-63, 1974

Notes:

¹Totals do not add to 100.0 because of rounding errors.

TABLE XIX

Historic Distribution of Chinese Exports
and Imports by Country, 1928-1936

(percent)

Country	Exports	Imports
United States	20	20
Japan	20	20
United Kingdom	10	10
Germany	10	10
Hong Kong	20	--
All Other Countries	<u>20</u>	<u>40</u>
All Countries	100	100

This projection assumes that the rate of worldwide inflation will decline to the level of the 1960's. It also assumes that the current trade environment will prevail; that is, there will be no significant shifts in the trade shares.

A second set of projections is made, based on the assumption that the trade environment will be "normalized". It is assumed that under these conditions, the U. S. share of China's non-Communist trade will be approximately 20 percent for both exports and imports. Since the share of China's Communist trade has approximately stabilized at 20 percent for both exports and imports, this implies that the U. S. share of total Chinese trade for both exports and imports will be 16 percent under "normalization." Chinese exports to and imports from non-Communist countries in 1980 are projected to be \$7,400 million and \$8,100 million respectively, using again a 9.6 percent growth rate. Then applying the 20 percent ratio projected Chinese exports to the U. S. in 1980 are \$1,480 million; projected Chinese imports from the U. S. are \$1,620 million, for a total trade of \$3,100 million. The alternative projections are summarized below:

Projected China-U. S. Trade (1980)
(Million U. S. Dollars)

Total Trade		Exports		Imports	
Current Environment	"Normalized" Environment	Current	Normalized	Current	Normalized
1,670	3,100	120	1,480	1,550	1,620

While the projected U. S. exports to China figures are relatively insensitive to alternative assumptions on the environment, the projected U. S. imports from China figures are highly sensitive.

U. S. imports can be as high as \$1,480 million dollars per year in 1980, compared to the current environment level of \$120 million dollars per year. It may be speculated that a substantial part of these imports will be transported through West Coast ports.

The commodity composition of these potential imports probably follows the existing composition of Chinese exports to Western Europe, which is presented below.

Commodity Composition of Chinese Exports
to Western Europe, 1973

(percent)

Foodstuffs	22.1
Crude materials, fuels and edible oils	31.2
Chemicals	7.4
Manufactures	38.6
Other	<u>0.6</u>
TOTAL	99.9

Foodstuffs include principally animals, meat and fish, and fruits and vegetables. Crude materials include principally oil, seeds, textile fibers, and crude animal materials. Manufactures include principally textile yarn and fabric, clothing, and nonferrous metals. All these items are likely to be shipped either as general cargo or in containers.

2. U. S. S. R.

Soviet trade with the U. S. was approximately constant at the rate of less than \$100 million per year in the sixties. However, trade began to take off in 1970, with the total volume reaching \$1,400 million in 1973. (See Figure 2).

The commodity composition of U. S.-U. S. S. R. trade as well as that of Western Europe-U. S. S. R. trade is presented in TABLE XX. It is immediately apparent that the U. S. trade is disproportionately concentrated in foodstuffs (mostly food grains) relative to Western Europe.

Total imports from the U. S. S. R. under "normalized" conditions have been projected by the staff of the East-West Trade Bureau to grow at 8.5 percent per year from 1971-1980. Given the 1973 imports of \$214 million, this implies a figure of \$379 million in 1980. The alternative is slow, or no growth, particularly in view of the cancellation of the 1972 U. S. -U. S. S. R. trade agreement.

Millions Of U.S. Dollars

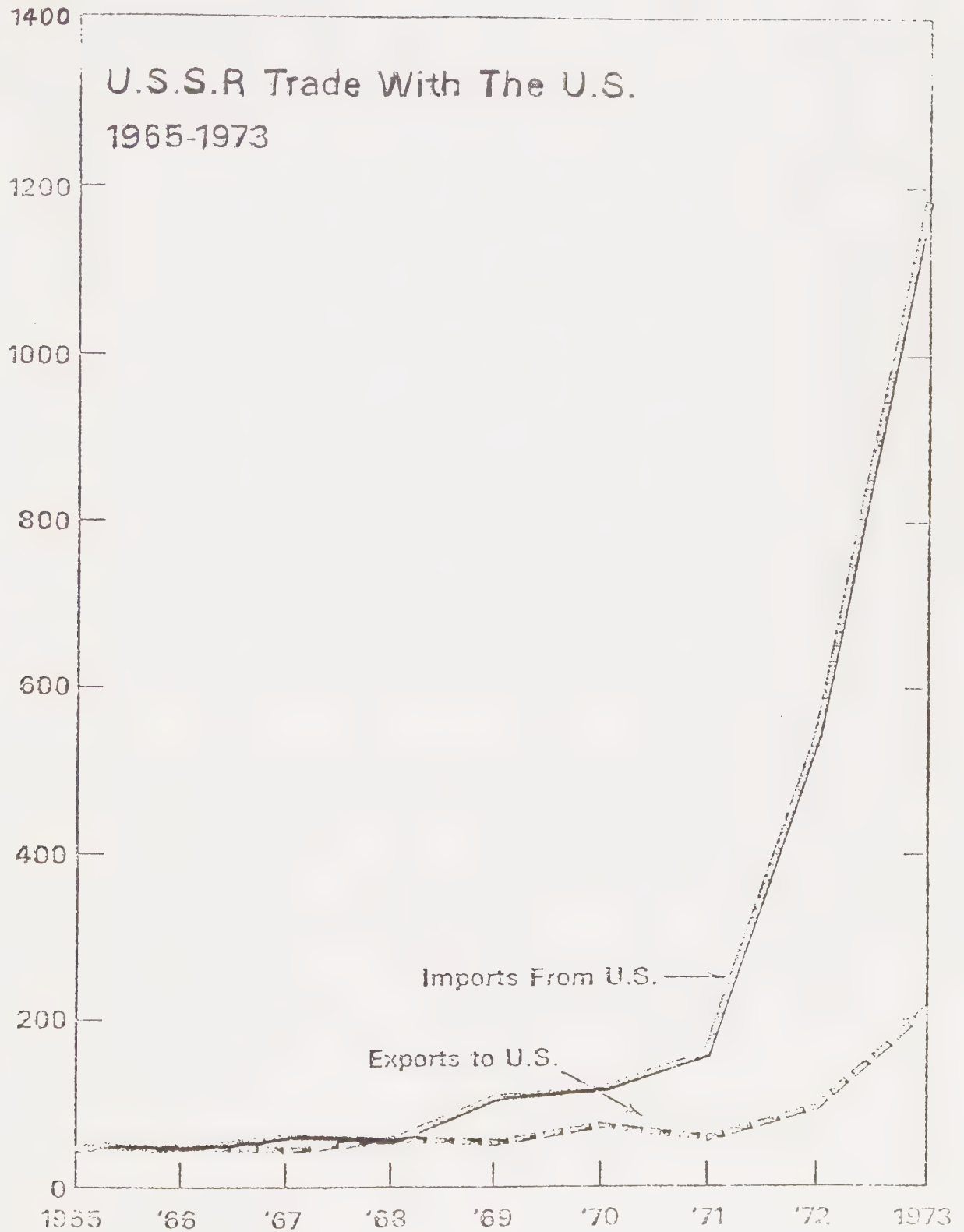


TABLE XX

U.S.S.R. Composition of Trade with the U.S. and Western Europe
(percent)

Commodity	Exports		Imports	
	To U.S. (1973)	Western Europe (1973)	From U.S. (1973)	Western Europe (1973)
Foodstuffs and edible oils	.4	9.9	71.4	15.2
Crude materials and fuels	40.6	65.2	6.1	2.0
Chemicals	1.1	3.1	1.4	9.7
Manufactures	55.3	17.1	2.9	30.5
Machinery	.1	3.1	17.3	36.8
Other	2.5	1.6	.9	5.8

Source: Selected U.S.S.R. and Eastern European Trade and Economic Data, Domestic and International Business Administration, Bureau of East-West Trade, U.S. Department of Commerce, Washington, D. C., May 1974.

Total exports to the U. S. S. R. have been projected at between \$684 million and \$1051 million for 1978 under "normalized" conditions compared to a 1973 total of \$1187 million. The 1973 figure is abnormally high because of large grain purchases. The alternative no growth projection for 1978 is between \$232 million and \$387 million. The values for 1980 will probably not be too far from these alternative ranges.

E. WEST COAST TRADE WITH THE P. R. C. AND THE U. S. S. R.

West Coast tonnage figures were compiled from Census Bureau print-outs for the years 1970 through 1972. A preliminary analysis concerning potential trade with the People's Republic of China and the U. S. S. R. revealed this to be an insufficient data base for the making of long term projections. Consequently, figures presented here may not be a valid indicator of future trade.

Despite this qualification, early findings seem to indicate that Pacific Northwest ports would handle a majority of the dry bulk exports with the San Francisco Bay Region and Southern California ports handling such exports on a secondary basis. However, future imports would most probably be shipped to the larger markets in California. Most future general cargo imports should be handled by California ports.

1. People's Republic of China

Between 1971 and 1972 imports from the People's Republic of China handled by West Coast ports increased from 293 to 3,542 short tons. Most notable among the commodity groups responsible for this increase were: ^{3/} farm products (19 to 607); food and related products (166 to 1043); basic textiles (2 to 225); lumber and wood products, except furniture (2 to 125); stone, clay and glass products (9 to 394); fabricated metal products (4 to 205); and miscellaneous manufactured products (2 to 356).

During 1972 imports from the P. R. C. handled by the Los Angeles Customs District increased in both absolute and relative terms. The most notable increases were in the following commodity groups: stone, clay, and glass products (4 to 105); food and related products (3 to 463); and farm products (8 to 435). Although the proportion of 1972 imports handled within the San Francisco Customs District increased relative to the 1971 tonnage level, the Los Angeles Customs District replaced San Francisco as the leading importer of goods from the P. R. C. for 1972.

Wheat comprised 286,489 or 99.96% of the total 286,609 short tons exported to the People's Republic during 1972. Activity within the Portland Customs District accounted for the shipment of 277,137 short tons of wheat while the remaining 9,352 short tons were handled by the Seattle Customs District. The balance

^{3/} Figures in parentheses pertain to actual short tonnage for 1971 and 1972 respectively.

of the commodity mix exported to the P. R. C. during 1972 was 18 short tons of food and related products - handled by the Seattle Customs District; and 103 short tons of electrical machinery - 101 short tons handled by the Port of San Francisco, one ton by the Port of Oakland, and one ton by the Los Angeles Customs District. Also evidencing an increasing trend during this period were: forest products (1 to 29); fresh fish (0 to 2); non-metallic minerals, except fuel (0 to 20); apparel and textile products (7 to 52); furniture and fixtures (4 to 40); pulp and paper products (0 to 8); chemicals and chemical products (74 to 225); rubber and rubber products (1 to 78); primary metal products (0 to 91); electrical machinery (0 to 15); transportation equipment (0 to 12); instruments, photographic and optical equipment (0 to 5); waste and scrap (0 to 2); and special items (0 to 1).

2. U. S. S. R.

Displaying significant decreases between 1971 and 1972 were West Coast imports of: primary metal products (1173 to 361); chemicals and chemical products (112 to 1); food and related products (34 to 0); and fabricated metal products (160 to 3). Also, decreasing during this period were imports of: transportation equipment (1 to 0); farm products (25 to 21); and stone, clay and glass products (5 to 0).

West Coast imports of the following commodities increased from 1971 to 1972: forest products (0 to 3 short tons); ordnance and accessories (0 to 5); pulp and paper products (0 to 3); printed

matter (0 to 1); and miscellaneous manufactured products (9 to 21).

Imports of basic textiles, lumber and wood products except furniture, and electrical machinery remained unchanged.

The sharp increase in tonnage exported from the West Coast to the Soviet Union during 1972 was almost singularly due to wheat, which accounted for 295,631 of a total 296,373 short tons. Other West Coast exports and their relative changes during the three-year period 1970 to 1972 were: ^{4/} food and related products (646 to 2171 to 691); furniture and fixtures (1 to 0 to 0); pulp and paper products (6364 to 0 to 0); printed matter (0 to 0 to 1); chemicals and chemical products (1 to 0 to 16); fabricated metal products (0 to 0 to 1); machinery, except electrical (48 to 3 to 12); electrical machinery (20 to 11 to 21); instruments, photographic and optical equipment, etc. (0 to 4 to 0).

If the export of wheat is disregarded, the general trend of exports to the Soviet Union during the 1970 to 1972 period is a decreasing one. When it is noted that this entire shipment of wheat was handled by the Customs District of Portland, Oregon, it is apparent why the decreased percentage of Soviet exports handled within the San Francisco Custom District is so acute. ^{5/}

^{4/} Figures in parentheses pertain to actual short tonnage during the years 1970, 1971 and 1972 respectively.

^{5/} Annual tonnage figures for the years 1970-1972 detailing trade with the U. S. S. R. and the People's Republic of China are summarized on Table XXI.

TABLE XXI
WEST COAST WATERBORNE COMMERCE
TRADE WITH THE PEOPLE'S REPUBLIC
OF CHINA AND THE U. S. S. R.
(Actual Short Tons)

People's Republic of China

	<u>Imports</u>			<u>Exports</u>		
	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Total West Coast (including Alaska & Hawaii)	101	293	3542	*	*	286609
San Francisco Bay Region	*	160	1250	*	*	102
San Francisco Bay Region share as percent of total	*	53.9	35.3	*	*	0.04

U. S. S. R.

	<u>Imports</u>			<u>Exports</u>		
	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Total West Coast (including Alaska & Hawaii)	1228	1522	422	7133	2189	296373
San Francisco Bay Region	1124	1229	23	699	2023	728
San Francisco Bay Region share as percent of total	87.3	79.2	5.4	9.8	92.4	0.3

* no tonnage recorded

IV. PROJECTION METHODOLOGY AND ANALYSIS

A. MULTIPLE REGRESSION ANALYTICAL FRAMEWORK

Waterborne commerce projections for the San Francisco Bay Region were derived from a general methodology developed under contract by Dr. Lawrence J. Lau, Department of Economics, Stanford University. This methodology titled, "A Methodology for the Projection of Waterborne Commerce Movements on the U. S. West Coast by Major Port Systems" is included as Appendix D of this study.

The methodology is flexible in that it allows expansion or contraction of the model according to data availability and time schedules. Also, the modular structure is multi-level so future research may be incorporated directly into the methodology. Projections are obtained from equations whose coefficients are estimated by multiple regression analysis. The methodology was applied according to the availability of historical and projected independent variable data. Supplementary information was used in determining projections when variable data were either unavailable or unreflective of expected future developments. The following sections present the detailed application of this methodology for projecting the San Francisco Bay Region and Delta Area waterborne commerce.

1. Projection of Imports

The approach taken for projecting foreign imports specified the following assumptions: First, imports are primarily demand-determined;

this is to say that the San Francisco Bay Region port system can import as much as is desired at the prevailing price of imports, with no supply constraints. Second, the hinterland served by the San Francisco Bay Region port system is stationary. This means that any drastic reallocation of imports among West Coast port systems is attributable to changes in demand factors. Third, existing West Coast port systems, as well as the relative user costs of these systems' facilities, are given and no significant changes are foreseen. Fourth, there is no competitive reallocation of existing international trade routes.

Given the above assumptions, imports of a particular commodity at the San Francisco Bay Region are a function of the final consumption demand and the total intermediate demand of the commodity in the hinterland served by the San Francisco Bay Region port system. Import demand is thus a function of the foreign and domestic prices of the commodity in the San Francisco Bay Region, the general domestic price level of the region, the population, personal income, and industrial employment of the hinterland, and time. These functional relationships are expressed in the following two import demand equations:

$$(1) \quad M_{ij} = \alpha_o^i + \beta^i \frac{p_m^i}{p_c} + \gamma^i \frac{p_c^i}{p_c} + \delta^j \frac{y_j}{p_c} + \xi^j N^j + \eta^j E^j + p^{ij} t$$

$$(2) \frac{M_{ij}}{N} = \alpha_o + \beta \frac{p_m^i}{p_c^j} + \gamma \frac{p_c^i}{p_c^j} + \delta \frac{(y^j/N^j)}{p_c^j} + \frac{\eta^j E^j}{N^j} + p_{ij}^j t$$

Where M_{ij} represents imports of the i th commodity, in tons, at the j th port system; p_m^i is the import price index of the i th commodity with base year 1967; p_c^j is the consumer price index in the j th region with base year 1967; p_c^i is the domestic price index of the i th commodity with year 1967; Y^j is the total personal income in the j th region; N^j is the total population in the j th region; E^j is industrial employment in the j th region; and t is time.

Equations (1) and (2) represent the total and per capita versions of the import demand function. Both equations satisfy the assumption of zero degree homogeneity in prices. The choice between equations to be used in deriving projections is based on relative goodness of fit. The expected signs of the coefficients are $\beta^i \leq 0$; $\gamma^i \geq 0$; $\delta^j \geq 0$; $\xi^j \geq 0$; and $\eta^j \geq 0$.

Tonnage data (the dependent variable) was compiled for the San Francisco Bay Region (including the Delta) from the annual publication titled Waterborne Commerce of the United States - Part 4 for the years 1950 through 1973. Data from this source was collected by two-digit commodity groups for exports, imports, coastwise receipts, and coastwise shipments.

Data for the independent variables in equations (1) and (2) were tabulated from the following sources. A world export price index was substituted for the import price index as specified in equations (1) and (2) due to the unavailability of import price index data. This world export price index was compiled from Special Table B in the Monthly Bulletin of Statistics, as published by the United Nations. A historical series, for the years 1950-1973 (inclusive), was tabulated for the following nine commodities and commodity groups: Coffee, tea, and cocoa; cereals; fats, oils, and oil seeds; textiles; wool; manufactured goods; non-ferrous base metal; metal ores; and fuels (series from 1956-1973). These world export price indices were converted to a 1967=100 base and allocated to the Corps' two-digit commodity groups. The world export price indices were then divided by the U. S. consumer price index (1967 = 100) in order to achieve zero degree homogeneity in prices. (Unless otherwise noted, all price indices and personal income were divided by the U. S. consumer price index so as to eliminate any money illusion. All indices were converted to a 1967 base.) The consumer price index used in these divisions is for the San Francisco-Oakland area (all items) as found in the California Statistical Abstract.

The domestic price index, as reflected by the U. S. wholesale price index, was compiled from the Statistical Abstract of the United States for 1950 through 1973 by commodity. The allocation of these

indices to the Corps' two-digit commodity groups was achieved with a minimum of distortion.

Personal income and population data for the time periods 1950 to 1972 and 1950 to 1973, respectively, were compiled from the California Statistical Abstract. The hinterland considered in this analysis includes the BEA (Bureau of Economic Analysis) areas numbered 167, 168, and 171. The personal income and population figures were compiled by the counties corresponding to these BEA areas. Personal income was interpolated for the years 1951, 1952, 1953, 1954, and 1956. Following is a table of the counties included in their respective BEA areas.

Counties Included in San Francisco Bay Region Port System BEA'S
(#167, 168, and 171)

<u>Stockton (#167)</u>	<u>Sacramento (#168)</u>	<u>San Francisco (#171)</u>
Alpine	Butte	Alameda
Amador	Colusa	Contra Costa
Calaveras	El Dorado	Lake
Mariposa	Glenn	Marin
Merced	Nevada	Mendocino
San Joaquin	Placer	Monterey
Stanislaus	Sacramento	Napa
Tuolumne	Sutter	San Benito
	Yolo	San Francisco
	Yuba	San Mateo
		Santa Clara
		Santa Cruz
		Solano
		Sonoma

Industrial employment data by Standard Metropolitan Statistical Area (SMSA) for 1950 to 1973 was taken from the publication: Estimated Number of Wage and Salary Workers in Nonagricultural Establishments, By Industry as published by the Department of Industrial Relations, Division of Labor Statistics and Research, Human Relations Agency, State of California. As these figures were by SMSA, a correlation of SMSA to BEA areas had to be made. Following is a table of those SMSA areas that were allocated to BEA areas #167, #168, and #171.

<u>Stockton BEA #167</u>	<u>Sacramento BEA #168</u>	<u>San Francisco BEA #171</u>
Stockton SMSA	Sacramento SMSA	San Francisco SMSA
Modesto SMSA		Salinas-Monterey SMSA
		Vallejo-Napa SMSA
		San Jose SMSA
		Santa Rosa SMSA

2. Projection of Exports

The methodology for the projection of exports is different from that used in projecting imports because under the assumptions of a demand - determined system, one can not explain the quantity of exports primarily on the basis of developments in the United States. It is the developments in the using countries that determine, to a large extent, the quantity of exports. Ideally, one should consider the particular circumstances of each important using country. In this study the lack of available data prevented such detailed considerations. Instead, this study undertook a general approach as exemplified by the following export equation:

$$(3) \quad X_{ij}^i = \alpha_o^i + \beta_x^{ii} P_x^i + \gamma_w^{ii} P_w^i + \delta_w^{ii} M_w^i + \eta_t^{ij}$$

Where X_{ij}^i represents exports of the i th commodity from the j th port system; P_x^i is the export price index of the i th commodity; P_w^i is the world price index of the i th commodity; M_w^i is the total world imports of the i th commodity; and t is time. The expected signs of the coefficients are: $\beta_x^i \leq 0$; $\gamma_w^i \geq 0$; and $\delta_w^i \geq 0$. In the above model, represented by equation (3), all supply factors act through the price variables. Also, world imports is used as the independent variable rather than other foreign economic activity variables so as to minimize the need for projecting these foreign economic activities. Finally, since supply factors are not explicitly addressed in this model there is no need to consider the hinterland.

The sources for the historical variable data used in export equation (3) were the following. The export price index and world price index variable data were tabulated from the Statistical Abstract of the United States and Special Table B in the Monthly Bulletin of Statistics, respectively. In equation (3), the U. S. wholesale price index represents the export price index and the world export price index represents the world price index.

The independent variable, total world imports, was tabulated from Special Table D in the Monthly Bulletin of Statistics. Although total world imports less U. S. imports data would be more applicable

to the analysis, this data was available only for a short time series. Data was available, however, for total world imports less North American imports for the years 1955 through 1972. This data is in the form of U. S. dollars by one-digit S. I. T. C. (Standard International Trade Classification) category. The one-digit S. I. T. C. categories are:

- 0 and 1 - Food & Live Animals and Beverages & Tobacco
- 2 and 4 - Crude Materials, Inedible, Except Fuels and Animal & Vegetable Oils & Fats
- 3 - Mineral Fuels & Related Materials
- 5 - Chemicals
- 7 - Machinery & Transportation Equipment
- 6 and 8 - Manufactured Goods Classified Chiefly by Material Division and Miscellaneous Manufactured Articles
- 9 - Commodities & Transactions NEC

These total world imports less North American import values were divided by the world export price index and allocated to the Corps' two-digit commodity groups.

3. Projection of Coastwise Receipts

The projection of coastwise receipts was treated in the same manner as the projection of imports with the exception of price variables. Data unavailability prevented the construction of a receipts price index. The equations for the projection of coastwise receipts are presented on the following page.

$$(4) \quad R_{ij} = \alpha_o^i + \beta^i S^i + \delta^j \frac{Y^j}{p_c^j} + \xi^j N^j + \eta^j E^j + p^i t^j$$

$$(5) \quad \frac{R_{ij}}{N^j} = \alpha_o^i + \beta^i S^i + \delta^j \frac{(Y/N)^j}{p_c^j} + \frac{\eta^j E^j}{N^j} + p^i t^j$$

Where R_{ij} represents coastwise receipts of the i th commodity at the j th port system; S^i is U. S. total coastwise shipments less San Francisco Bay Region coastwise shipments of the i th commodity; Y^j is the total personal income in the j th region (i.e., San Francisco Bay Region); p_c^j is the consumer price index in the j th region; N^j is the total population in the j th region; E^j is industrial employment in the j th region; and t is time. The expected signs of the coefficients are: $\beta^i \geq 0$; $\delta^j \geq 0$; $\xi^j \geq 0$; and $\eta^j \geq 0$.

The population, personal income and industrial employment independent variable data were tabulated from those sources mentioned previously in the projection of imports section. The independent variable data, net U. S. coastwise shipments, was compiled from the Waterborne Commerce of the United States, Part 5 - National Summaries. This tonnage data was aggregated to the two-digit commodity group level for the years 1950-1973 (inclusive).

4. Projection of Coastwise Shipments

The equation for the projection of coastwise shipments is:

$$(6) \quad S_{ij} = \alpha_o^i + \beta_{R^i}^i + p_{t^i}^i$$

Where S_{ij} represents the coastwise shipments of the i th commodity from the j th port system; R^i is U. S. coastwise receipts less San Francisco Bay Region coastwise receipts of the i th commodity; and t is time. The expected sign of the coefficient is; $\beta^i \geq 0$.

The independent variable, net U. S. coastwise receipts, was tabulated for the years 1950-1973 (inclusive) from Waterborne Commerce of the United States, Part 5 - National Summaries.

5. Projected Independent Variable Data

After equations (1) through (6) are estimated, it is necessary to obtain projected independent variable data for the years 1980, 2000, and 2020. The projected independent variable data were either derived by mechanical trendline projection ($Y_t = \alpha + \beta t$) or taken from published sources.

The world export price index, U. S. wholesale price index, world imports less North American imports, U. S. coastwise shipments less San Francisco Bay Region coastwise shipments, U. S. coastwise receipts less San Francisco Bay Region coastwise receipts, and San Francisco-Oakland consumer price index projected independent variables were

derived by time-trend projection. In those instances where the coefficients of the single regression were excessive, the projected value of the variable was determined by taking the average value of the historical observations and holding this value constant for 1980, 2000, and 2020.

The sources for the projected population and personal income variables were the OBERS Projections, as prepared by the U. S. Department of Commerce and the U. S. Department of Agriculture, and the Population Projections for California Counties 1975-2020, as prepared by the California Department of Finance. Both the OBERS Series C and Series E levels of population and personal income projections were used in calculating projected commodity tonnages. Also used were the California State Baseline Series D-100 population projections. OBERS Series C provides a high level projection, OBERS Series E a low level projection, and State Series D-100 a medium level projection. The difference in these projection levels are primarily due to different population growth rate assumptions. Since the State Series D-100 projections do not include projections of personal income, OBERS Series C and Series E personal income projections were assigned separately to the State Series D-100 population variable. This resulted in two medium level projections.

Projected industrial employment variable data was not determined as this variable was found unacceptable in the equation regressions.

This variable was unacceptable due to either multicollinearity with population and/or personal income variables or incorrect expected coefficient signs.

6. Multiple Regression Computations

The actual multiple regression computations of equations (1) through (6) were performed according to the 1130 Multiple Regression System developed by Elaine Borkon and James N. Boles of the Giannini Foundation of Agricultural Economics, University of California, Berkeley. This program was modified and adapted for use by a CDC7600 computer.

Multiple regression routines were computed for each two-digit commodity group using import, export, coastwise receipt, and coastwise shipment tonnage as the dependent variables. The following two forms of the basic regression equation were computed for each commodity group:

a) Linear: $Y = a + bX$

b) Log: $\text{Log } Y = a + b \log X$

The criteria for selecting the independent variables and the form of the regression equation to be used in computing the projected tonnages was as follows. The independent variables, to be ultimately used in projecting commodity tonnages, were selected on the basis of

expected signs of the coefficients. If a regression routine resulted in any variable having a wrong sign for the coefficient, then that variable was deleted from any future regressions. Regressions were made until all independent variable coefficients resulted in the expected signs. Next, the selection of the form of the regression equation (i.e., Linear or Log) was determined by the sum of the squared residuals. The equation with the lowest sum of the squared residuals was selected for determining projected commodity tonnages. Examples of this selection method for imports of farm products and exports of pulp, paper, & printed matter are presented below.

Imports of Farm Products - Four equations were used in regressing imports of farm products. These equations were: Linear real, Log real, Linear per capita, and Log per capita. The independent variables were: world price index, domestic price index, population, personal income, industrial employment, and time. (Note: for the Linear and Log per capita equations population was divided into the dependent variable (tons) and the independent variables personal income and industrial employment. (Reference equations (1) and (2)).

The first regression of each equation, which included all the independent variables, yielded incorrect coefficient signs (negative) for the domestic price index, personal income, and industrial employment variables. These variables were deleted, one at a time, in subsequent regressions in order to determine any

evidence of multicollinearity. No multicollinearity was detected and the variables continued to yield incorrect coefficient signs. Therefore, these variables were deleted before the fourth regression. The fourth regression resulted in the expected coefficient signs for the remaining independent variables (i.e., world price index, population and time) for each equation.

The choice as to which of the four equations would be used in projecting tonnages was based on the relative goodness of fit. The relative goodness of fit is measured by the sum of the squared residuals - a measure which varies directly with the degree of spread between the estimated function and the actual. The smaller the sum of the squared residuals the better the fit. In this particular case the Linear real equation had the lowest sum of the squared residuals. Thus, the final equation used for the projection of imports of farm products was Linear real and included the following independent variables: world price index, population, and time.

Exports of Pulp, Paper, & Printed Matter - The initial regressions for the Linear and Log forms of the equation consisted of the following four independent variables: export price index, world price index, total world imports, and time. (Reference equation (3)). The results of the initial regression of each equation revealed an incorrect coefficient sign (negative) for the world price index variable. Therefore, this variable was deleted

from each equation in the next regression. The second regression of each equation yielded correct coefficient signs for the remaining independent variables (i.e., export price index, total world imports, and time). The Log form of the equation had the lowest sum of the squared residuals.

The final equations selected and resulting regression statistics are presented by movement and commodity group in Appendix B.

7. Projection Assumptions

Once the selection of the independent variables and form of the equations were made, then projected commodity tonnages were computed. The computation of projected commodity tonnages was based on two assumptions: stationary expectations and trended expectations. These two projection assumptions have the effect of providing a high and low level of commodity tonnage projections. These two projection levels were achieved in the following manner. For the stationary expectation assumption, the values of the last observation for each independent variable (except the population, personal income, and time variables) were held constant throughout the projected time periods of 1980, 2000, and 2020. Under the trended expectation assumption, the projected independent variable values were used throughout the projected time periods. In addition, in projecting import and coastwise receipt tonnages, the three projected levels

of population and personal income (OBERS Series C, State Series D-100, and OBERS Series E) were used for each of the two projection assumptions. The use of the three projected population and personal income levels provided a "high," "medium," and "low" range of projected commodity tonnages. Thus, the combination of the two projection assumptions and three levels of projected population and personal income produced a maximum range of eight projected tonnage levels for imports and coastwise receipts each. These combinations were:

Stationary Expectation Assumption

- a) OBERS Series C population and personal income
- b) State Series D-100 population and OBERS Series C personal income
- c) State Series D-100 population and OBERS Series E personal income
- d) OBERS Series E population and personal income

Trended Expectation Assumption

- a) OBERS Series C population and personal income
- b) State Series D-100 population and OBERS Series C personal income
- c) State Series D-100 population and OBERS Series E personal income
- d) OBERS Series E population and personal income

8. Compiling the Tables

The range of projections for import and coastwise receipt commodity tonnages reflect the highest "high," lowest "low," and average "medium" derived from the previously mentioned eight combinations. The range of projections for export and coastwise shipment commodity tonnages were derived from the trended and stationary expectation assumptions, with the "medium" level being the average of the high and low levels.

In instances where the regression analysis yielded abnormally large projected tonnages, the projections were adjusted downward. While no downward adjustments were made to 1980 tonnages, 2000 and 2020 values were limited by assuming that over the period from 1972 to 2000 the average annual growth rate would not exceed 7.5 percent and over the period from 1972 to 2020 the growth rate would not exceed 5.0 percent per year. This downward adjustment is justified on the basis that excessively high growth rates cannot be sustained for the long term. In addition, field checking of the projections resulted in some adjustments due to changes in current or expected future conditions. The most significant adjustment was due to the proposed new petrochemical facilities of the Delta. Tonnages associated with these facilities were only included in the "high" and "medium" level projections, as these facilities may not be built.

9. Delta Area Projections

The Delta Area waterborne commerce projections were derived by the following method. The ratios of the Delta Area tonnage to the total San Francisco Bay Region tonnage were calculated for the most recent five-year historical period for each two-digit commodity group. The average of these ratios was then calculated and applied to the projections for the San Francisco Bay Region. This resulted in waterborne commerce projections for the Delta Area. One disadvantage of the average ratio method is that it does not reflect trends. Depending on whether the Delta's five-year historic tonnages were part of a positive or negative trend, the effect of the average ratio method would underestimate or overestimate the Delta Area projections.

B. MODE OF MOVEMENT ANALYSIS

An analysis was made of the mode of commodity movement. The four methods of shipping considered were: Container/LASH, Break Bulk, Dry Bulk and Liquid Bulk.

These are defined as follows:

Container - A standard protective metal box (nominally 8 X 8 X 20 feet) into which cargo may be packed for shipment. Cargo may be homogeneous or heterogeneous. Containers may be refrigerated or hold liquids as well as solids.

LASH (Lighter Aboard Ship) - Oceangoing vessels carrying cargo loaded in sealed, floatable boxes or barges which are off-loaded and loaded from the ship by cranes aboard the vessel and then pushed or towed to the docks.

Break Bulk - Heterogeneous items of cargo packed on pallets or other similar means of unitizing for lifting on and off a vessel. Does not include dry bulk, liquid bulk, or containerized cargo.

Dry Bulk - Cargo generally handled in bulk quantities, such as grains, ores, forest products, and metal scrap.

Liquid Bulk - Liquid cargo shipped in large enough quantities to make it practical to employ tankers rather than containers to be handled separately.

The modal split for projected tonnage was separately evaluated for the San Francisco Bay Area and Delta Area systems. In general, the modal analysis was made concurrently with the tonnage projections. The methodology employed for each subregion is described below.

San Francisco Bay Area - The modal split for the San Francisco Bay Area was performed, under contract, by Mr. A. Graham Atkins. Using 1972 commerce statistics as a base year, cargo (disaggregated to

the four-digit waterborne commerce commodity code level) was allocated to the four modes of movement described above. After consulting port authorities and shippers, as well as reviewing information from other Corps of Engineer Districts, MARAD reports, and trade journals, the following procedure was adopted. The first step was to isolate those commodities which by virtue of their characteristics, trade routes, and, to some extent, amounts of cargo, would tend to be handled by a particular mode. Also, specific consideration was given to whether the commodity was a foreign import or export, coastwise receipt or shipment. Dry bulk and liquid bulk commodities were readily separated by this process. However, deviation from these modes of movement sometimes occur. For example, bulk grain and rice has been shipped in containers. In this study, these deviations represent special cases and account for a small percentage of the Bay Area tonnage. These special cases were not considered in the projections.

The remaining general cargo commodities were then separated into container/LASH cargo and break bulk cargo. This modal split was primarily based on information obtained from the Ports of San Francisco and Oakland with some assistance from shippers. Military controlled container cargo was separated from civilian container cargo and not included in the projections.

Projections of mode of movement by four-digit commodity code groups were made for the years 1980 and 2000. The projected modal distribution for the year 2020 was the same as that used for 2000. This

is based on the assumption that most of the economic advantages of containerization would be achieved by the year 2000.

It does not appear that there will be a significant modal shift in the case of commodities currently being shipped as dry bulk or liquid bulk cargos. Commodities that moved as dry or liquid bulk in 1972 are essentially assumed to remain in that category over the projected time frame. This assumption is based on the nature and handling characteristics of these commodities.

The commodities included in the general cargo category are most susceptible to future containerization. In 1965, containerization of commodities was virtually non-existent; by 1970 it was estimated at 1.6 million tons and in 1972 at 2.8 million tons for the San Francisco Bay Area ports. This trend is expected to continue until 1980, when it is assumed that most of the containerizable commodities will have shifted to the container mode.

There is a wide range in the percentage of commodities being containerized due to the trade routes, vessel availability, tonnage involved, and nature of commodity. Some types of high-value, easily packaged cargos are largely containerized. In these cases, projected increases in containerization were relatively small. Other types of general cargo, while physically capable of being containerized, may experience a slow rate of change to containerization due to shape, value, or destination.

Historical trends and base-year data for each of the major commodity groups were analyzed at the four-digit commodity classification level. Container/LASH tonnage was related to total tonnage movement for each commodity at the four-digit level. Based on this information, curves were plotted projecting the percentage of container/LASH cargo to total general cargo. This data was then consolidated to the two-digit commodity code level and applied to the projected tonnages. The major container routes, such as the Far East, Europe, U. S. Coastwise including Hawaii and Alaska, were assumed to be augmented by further containerization of other routes such as South America.

Delta Area - The modal allocation of cargo for the Delta Area system was developed after examination of historical data, consideration of potential future fleets, and information obtained from the Corps' Sacramento District as well as shippers. Current information developed by the District for the Stockton Ship Channel Study and evaluation of current shipping trends for the Port of Sacramento were used extensively in the modal allocation.

The ultimate allocation of commodity tonnage to specific vessel types considered the trade route involved (including vessel availability on the route, harbor, commodity handling characteristics, average size of shipment, and the cost of movement by alternative modes). In general, dry and liquid bulk cargoes were allocated to vessels most appropriate to their cargo types.

Since the 1972 base year, some bulk cargo has moved by container barges and LASH vessels from the Delta. The allocation of this bulk cargo, which normally moves in other vessel types on the backhaul from the Delta to the Bay, to container/LASH vessels was considered. The allocation of bulk cargo to container/LASH vessels is based largely on incremental cost analysis, future fleet composition and the availability of space. The bulk cargo most likely to move by container/LASH vessels would be the high-value, long-haul commodities. Since the majority of the bulk cargo could not be allocated to container/LASH vessels, it was allocated to other vessel types. Container barge and LASH vessel traffic, to and from the Delta, is by definition an internal movement. Therefore, in order to prevent any double counting, tonnage allocated to container/LASH vessels is credited to the San Francisco Bay Area and the tonnages allocated to other vessel types is credited to the Delta Area.

Table XXII presents the percentage of tonnage by mode, for each movement in the San Francisco Bay Region for 1972.

TABLE XXII

SAN FRANCISCO BAY AREA IN-DEPTH STUDY
TOTAL SAN FRANCISCO BAY REGION
* PERCENT OF MODE TO MOVEMENT FOR 1972

MODE	EXPORTS	IMPORTS	RECEIPTS	SHIPMENTS
Container/LASH	13.4	20.7	9.1	6.8
Break Bulk	14.2	38.5	10.1	7.5
Dry Bulk	66.0	19.6	14.8	1.5
Liquid Bulk	6.4	21.3	66.0	84.2

* Totals may not sum to 100% due to rounding.

V. WATERBORNE COMMERCE PROJECTIONS

This chapter presents the range (i.e., high, medium, and low) of waterborne commerce projections for the San Francisco Bay Region in summary table form. The summary tables do not include the following commodities: crude petroleum; sand, gravel, and crushed rock; fresh fish; and Department of Defense controlled cargo.

Tables XXIII, XXIV, and XXV present the range of waterborne commerce projections by movement and method of shipment for the San Francisco Bay Region, the San Francisco Bay Area, and the Delta Area, respectively. Tables XXVI and XXVII present the range of waterborne commerce projections by commodity group and method of shipment for the San Francisco Bay Region and the Delta Area.

Appendix A presents the medium level waterborne commerce projections by movement, commodity group, and method of shipment for the San Francisco Bay Region (Tables A-1 through A-4) and Delta Area (Tables A-5 through A-8).

For planning purposes, it is advised that the medium-range projections be used as the baseline series. However, the identification of a baseline series should not preclude consideration of the other projection ranges. The high-medium-low range of projections should always be considered in a sensitivity analysis on plans or decisions.

TABLE XXIII
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR TOTAL SAN FRANCISCO BAY REGION

(Thousands of Short Tons)

	1972					1980					2000					2020				
	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
	Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
HIGH																				
Imports	-	-	-	-	-	2,859	2,409	1,452	695	7,415	13,507	3,369	5,064	2,345	24,285	18,110	4,649	10,461	5,146	38,366
Exports	-	-	-	-	-	2,032	844	8,287	775	11,938	4,580	1,266	18,231	1,749	25,826	7,581	1,796	31,513	2,601	43,491
Receipts	-	-	-	-	-	1,075	567	1,350	8,253	11,245	2,871	724	3,265	10,394	17,254	7,731	3,108	6,837	14,403	32,079
Shipments	-	-	-	-	-	1,634	952	352	6,217	9,155	3,410	982	477	6,918	11,787	9,165	1,544	657	7,619	18,985
TOTAL	-	-	-	-	-	7,600	4,772	11,441	15,940	39,753	24,368	6,341	27,037	21,406	79,152	42,587	11,097	49,468	29,769	132,921
MEDIUM																				
Imports	801.0	1,492.1	758.6	824.1	3,875.8	2,502	1,967	1,102	466	6,037	11,509	2,710	3,392	1,601	19,212	15,494	3,666	6,409	3,102	28,671
Exports	634.5	674.9	3,131.6	305.2	4,746.2	1,651	642	6,377	750	9,420	3,131	784	11,963	1,552	17,430	4,755	1,082	18,837	2,273	26,947
Receipts	599.8	666.2	969.6	4,337.3	6,572.9	886	467	1,163	7,312	9,828	2,086	473	2,003	9,532	14,094	5,358	1,715	3,783	13,419	24,275
Shipments	773.9	854.5	167.8	9,587.0	11,383.2	1,402	913	265	6,111	8,691	2,785	794	349	4,300	8,228	7,105	1,160	448	3,990	12,703
TOTAL	2,809.2	3,687.7	5,027.6	15,053.6	26,578.1	6,441	3,989	8,907	14,639	38,976	19,511	4,761	17,707	16,985	58,964	32,712	7,623	29,477	22,784	92,596
LOW																				
Imports	-	-	-	-	-	2,187	1,630	859	237	4,913	9,674	2,246	2,150	846	14,916	13,945	3,201	3,650	1,060	21,856
Exports	-	-	-	-	-	1,261	443	4,280	102	6,086	1,674	302	5,089	97	7,162	1,930	366	5,898	98	8,292
Receipts	-	-	-	-	-	772	385	1,044	2,041	4,242	1,588	253	1,355	807	4,003	3,518	401	2,283	1,188	7,390
Shipments	-	-	-	-	-	4,172	869	180	5,866	8,087	2,160	609	223	1,537	4,529	5,046	776	238	207	6,267
TOTAL	-	-	-	-	-	5,392	3,327	6,363	8,246	23,328	15,096	3,410	8,817	3,287	30,610	24,439	4,744	12,069	2,553	43,805

Discrepancies between tables are due to rounding errors.

TABLE XXIV
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR SAN FRANCISCO BAY AREA

(Thousands of Short Tons)

	1972					1980					2000					2020				
	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
HIGH	Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
Imports	-	-	-	-	-	2,859	2,351	908	587	6,705	13,507	3,211	3,192	2,047	21,957	18,110	4,478	6,457	4,847	33,892
Exports	-	-	-	-	-	2,032	599	3,094	150	5,875	4,580	620	6,494	493	12,187	7,581	725	13,682	753	22,741
Receipts	-	-	-	-	-	1,075	524	898	2,937	5,434	2,871	680	2,042	1,515	7,108	7,731	3,055	5,042	1,777	17,605
Shipments	-	-	-	-	-	1,634	928	158	4,799	7,519	3,410	947	192	5,323	9,872	9,165	1,494	258	5,847	16,764
TOTAL	-	-	-	-	-	7,600	4,402	5,058	8,473	25,533	24,368	5,458	11,920	9,378	51,124	42,587	9,752	25,439	13,224	91,002
MEDIUM																				
Imports	801.0	1,450.3	482.2	721.8	3,455.3	2,502	1,918	674	373	5,467	11,509	2,575	2,082	1,315	17,481	15,494	3,503	3,914	2,803	25,714
Exports	634.5	521.2	1,535.3	305.2	2,996.2	1,651	473	2,553	125	4,802	3,131	389	4,599	296	8,415	4,755	429	8,446	425	14,055
Receipts	599.8	453.1	822.8	3,968.1	5,843.8	886	427	742	2,088	4,143	2,086	432	1,334	781	4,633	5,358	1,673	2,979	1,056	11,066
Shipments	773.9	836.2	64.9	8,752.3	10,427.3	1,402	889	120	4,713	7,124	2,785	760	142	3,229	6,916	7,105	1,111	178	2,944	11,338
TOTAL	2,809.2	3,260.8	2,905.2	13,747.4	22,722.6	6,441	3,707	4,089	7,299	21,536	19,511	4,156	8,157	5,621	37,445	32,712	6,716	15,517	7,228	62,173
LOW																				
Imports	-	-	-	-	-	2,187	1,591	537	160	4,475	9,674	2,144	1,247	573	13,638	13,945	3,050	2,273	761	20,029
Exports	-	-	-	-	-	1,261	351	2,016	102	3,730	1,674	158	2,699	97	4,628	1,930	132	3,208	98	5,368
Receipts	-	-	-	-	-	772	347	657	1,754	3,530	1,588	218	898	514	3,218	3,518	369	1,646	684	6,217
Shipments	-	-	-	-	-	1,172	845	83	4,614	6,714	2,160	575	93	1,114	3,942	5,046	727	96	12	5,881
TOTAL	-	-	-	-	-	5,392	3,134	3,293	6,630	18,449	15,096	3,095	4,937	2,298	25,426	24,439	4,278	7,223	1,555	37,495

Discrepancies between tables are due to rounding errors.

TABLE XXV
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR DELTA AREA

(Thousands of Short Tons)

	1972					1980					2000					2020				
	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
	Container/ LASH	1/ Bulk				Container/ LASH	1/ Bulk				Container/ LASH	1/ Bulk				Container/ LASH	1/ Bulk			
HIGH																				
Imports	-	-	-	-	-	78	58	544	108	710	281	158	1,872	298	2,328	423	171	4,004	299	4,474
Exports	-	-	-	-	-	347	245	5,193	625	6,063	645	646	11,737	1,256	13,639	1,056	1,071	17,831	1,848	20,750
Receipts	-	-	-	-	-	-	43	452	5,316	5,811	-	44	1,223	8,879	10,146	-	53	1,795	12,626	14,474
Shipments	-	-	-	-	-	78	24	194	1,418	1,636	99	35	285	1,595	1,915	187	50	399	1,772	2,221
TOTAL	-	-	-	-	-	503	370	6,383	7,467	14,220	1,025	883	15,117	12,028	28,028	1,666	1,345	24,029	16,545	41,919
MEDIUM																				
Imports	26.4	41.8	276.4	102.3	420.5	69	49	428	93	570	264	135	1,310	286	1,731	405	163	2,495	299	2,957
Exports	100.4	153.7	1,596.3	-	1,750.0	263	169	3,824	625	4,618	436	395	7,364	1,256	9,015	652	653	10,391	1,848	12,892
Receipts	-	213.1	146.8	369.2	729.1	-	40	421	5,224	5,685	-	41	669	8,751	9,461	-	42	804	12,363	13,209
Shipments	-	18.3	102.9	834.7	955.9	69	24	145	1,398	1,567	78	34	207	1,071	1,312	150	49	270	1,046	1,365
TOTAL	126.8	426.9	2,122.4	1,306.2	3,855.5	292	282	4,818	7,340	12,440	778	605	9,550	11,364	21,519	1,207	907	13,960	15,556	30,423
LOW																				
Imports	-	-	-	-	-	57	39	322	77	438	246	102	903	273	1,278	391	151	1,377	299	1,827
Exports	-	-	-	-	-	174	92	2,264	Neg	2,356	215	144	2,390	Neg	2,534	242	234	2,690	Neg	2,924
Receipts	-	-	-	-	-	-	38	387	287	712	-	35	457	293	785	-	32	637	504	1,173
Shipments	-	-	-	-	-	41	24	97	1,252	1,373	56	34	130	423	587	109	49	142	195	386
TOTAL	-	-	-	-	-	272	193	3,070	1,616	4,879	517	315	3,880	989	5,184	742	466	4,846	998	6,310

1/ Container/LASH cargoes constitute internal shipments between Delta and San Francisco Bay Ports. They are consequently excluded from the Delta totals.
Discrepancies between tables are due to rounding errors.

TABLE XXVI
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR TOTAL SAN FRANCISCO BAY REGION ^{1/}

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products																				
	High	-	-	-	-	-	664	309	2,996	-	3,969	898	261	3,934	-	5,093	1,198	305	5,486	-	6,989
	Medium	204.6	323.0	523.0	-	1,050.6	433	199	1,903	-	2,535	483	92	2,369	-	2,944	641	123	3,144	-	3,908
	Low	-	-	-	-	-	206	117	813	-	1,136	171	29	803	-	1,003	171	29	803	-	1,003
08	Forest Products																				
	High	-	-	-	-	-	28	-	-	-	28	67	-	-	-	67	87	-	-	-	87
	Medium	8.2	-	-	-	8.2	25	-	-	-	25	65	-	-	-	65	86	-	-	-	86
	Low	-	-	-	-	-	22	-	-	-	22	62	-	-	-	62	85	-	-	-	85
10	Metallic Ores																				
	High	-	-	-	-	-	1	-	595	-	596	1	-	1,363	-	1,364	1	-	3,375	-	3,376
	Medium	-	-	83.3	-	83.3	1	-	393	-	394	1	-	572	-	573	1	-	1,539	-	1,540
	Low	-	-	-	-	-	1	-	213	-	214	1	-	2	-	3	1	-	232	-	233
11 & 14	Non-Metallic Minerals & Coal																				
	High	-	-	-	-	-	13	Neg	1,727	-	1,740	24	2	4,946	-	4,972	69	5	12,726	-	12,800
	Medium	.1	.3	1,138.5	-	1,138.9	13	Neg	1,441	-	1,454	19	1	2,933	-	2,953	38	4	6,545	-	6,587
	Low	-	-	-	-	-	8	Neg	1,162	-	1,170	7	1	1,355	-	1,363	7	2	1,918	-	1,927
20 & 21	Food & Tobacco Products																				
	High	-	-	-	-	-	2,565	894	1,751	513	5,723	6,903	926	3,710	1,314	12,853	10,073	1,247	7,245	2,062	20,627
	Medium	1,060.1	703.3	1,039.3	299.5	3,102.2	2,165	765	1,494	432	4,856	5,990	837	2,744	1,118	10,689	8,220	1,104	4,649	1,600	15,573
	Low	-	-	-	-	-	1,802	637	1,310	369	4,118	5,213	757	2,047	981	8,998	6,731	980	2,772	1,293	11,776
22 & 23	Textiles & Apparel Products																				
	High	-	-	-	-	-	102	-	-	-	102	248	-	-	-	248	551	-	-	-	551
	Medium	80.8	1.3	-	-	82.1	93	-	-	-	93	166	-	-	-	166	372	-	-	-	372
	Low	-	-	-	-	-	75	-	-	-	75	100	-	-	-	100	236	-	-	-	236

TABLE XXVI
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR TOTAL SAN FRANCISCO BAY REGION 1/

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL
24 & 25	Lumber & Furniture Products	-	-	-	-	-	219	167	929	-	1,315	980	466	4,413	-	5,859	2,903	752	5,996	-	9,651
	High	-	-	-	-	-	149	104	562	-	815	620	252	2,299	-	3,171	2,155	463	2,971	-	5,589
	Medium	112.0	175.1	513.8	-	800.9	112	45	144	-	301	391	43	Neg	-	434	1,706	190	Neg	-	1,896
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26 & 27	Pulp, Paper, Printed Matter	-	-	-	-	-	475	424	-	-	899	2,368	573	-	-	2,941	6,972	1,299	-	-	8,271
	High	-	-	-	-	-	339	214	-	-	553	1,347	234	-	-	1,581	4,353	533	-	-	4,886
	Medium	83.7	219.5	-	143.0	446.2	233	85	-	-	318	686	37	-	-	723	2,545	139	-	-	2,684
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Chemicals & Allied Products	-	-	-	-	-	718	421	286	1,808	3,233	2,419	478	1,108	2,714	6,719	4,184	686	1,990	4,422	11,282
	High	-	-	-	-	-	668	379	253	1,771	3,071	1,866	364	798	2,409	5,437	3,049	530	1,344	3,771	8,694
	Medium	214.9	327.0	126.5	244.2	912.6	627	347	219	375	1,568	1,363	256	466	733	2,818	2,094	407	656	1,248	4,405
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Petroleum Products	-	-	-	-	-	-	299	-	13,618	13,917	-	326	-	17,378	17,704	-	372	-	23,283	23,655
	High	-	-	-	-	-	-	289	-	12,436	12,725	-	195	-	13,458	13,653	-	185	-	17,413	17,598
	Medium	-	475.7	-	14,366.9	14,842.6	-	280	-	7,502	7,782	-	66	-	1,574	1,640	-	Neg	-	12	12
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Rubber & Plastic Products	-	-	-	-	-	61	-	-	-	61	220	-	-	-	220	716	-	-	-	716
	High	-	-	-	-	-	55	-	-	-	55	157	-	-	-	157	448	-	-	-	448
	Medium	37.3	.3	-	-	37.6	49	-	-	-	49	97	-	-	-	97	193	-	-	-	193
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Leather Products	-	-	-	-	-	125	-	-	-	125	178	-	-	-	178	288	-	-	-	288
	High	-	-	-	-	-	98	-	-	-	98	170	-	-	-	170	252	-	-	-	252
	Medium	36.2	.4	-	-	36.6	83	-	-	-	83	161	-	-	-	161	217	-	-	-	217
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XXVI
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR TOTAL SAN FRANCISCO BAY REGION 1/
(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	TOTAL
32	Stone, Clay, Glass Products	-	-	-	-	-	4	585	20	-	609	5	887	47	-	939	8	3,013	95	-	3,116
	High	-	-	-	-	-	4	500	18	-	522	4	653	34	-	691	5	1,705	54	-	1,764
	Medium	2.0	167.9	15.8	-	185.7	4	500	18	-	522	4	653	34	-	691	5	1,705	54	-	1,764
	Low	-	-	-	-	-	3	419	17	-	439	3	434	26	-	463	3	450	34	-	487
33	Primary Metal Products	-	-	-	-	-	1,163	841	2,041	-	4,045	5,539	1,278	5,149	-	11,966	5,955	1,499	7,996	-	15,450
	High	-	-	-	-	-	1,163	841	2,041	-	4,045	5,539	1,278	5,149	-	11,966	5,955	1,499	7,996	-	15,450
	Medium	326.6	732.2	949.9	-	2,008.7	1,083	784	1,821	-	3,688	4,790	1,097	4,023	-	9,910	5,836	1,381	5,929	-	13,146
	Low	-	-	-	-	-	991	725	1,596	-	3,312	3,756	862	2,807	-	7,425	5,724	1,270	3,861	-	10,855
34	Fabricated Metal Products	-	-	-	-	-	120	21	-	-	141	205	11	-	-	216	318	19	-	-	337
	High	-	-	-	-	-	120	21	-	-	141	205	11	-	-	216	318	19	-	-	337
	Medium	98.5	42.9	-	-	141.4	103	18	-	-	121	160	9	-	-	169	229	13	-	-	242
	Low	-	-	-	-	-	84	14	-	-	98	115	6	-	-	121	139	7	-	-	146
35	Machinery, Except Electrical	-	-	-	-	-	309	77	-	-	386	969	101	-	-	1,070	1,439	137	-	-	1,576
	High	-	-	-	-	-	309	77	-	-	386	969	101	-	-	1,070	1,439	137	-	-	1,576
	Medium	109.8	76.1	-	-	185.9	300	73	-	-	373	957	100	-	-	1,057	1,383	136	-	-	1,519
	Low	-	-	-	-	-	294	72	-	-	366	936	100	-	-	1,036	1,301	135	-	-	1,436
36	Electrical Machinery	-	-	-	-	-	303	24	-	-	327	758	46	-	-	804	1,468	81	-	-	1,549
	High	-	-	-	-	-	303	24	-	-	327	758	46	-	-	804	1,468	81	-	-	1,549
	Medium	96.5	11.9	-	-	108.4	273	22	-	-	295	683	42	-	-	725	1,312	73	-	-	1,385
	Low	-	-	-	-	-	239	19	-	-	258	607	38	-	-	645	1,157	65	-	-	1,222

TABLE XXVI
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR TOTAL SAN FRANCISCO BAY REGION ^{1/}

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
37	Transportation Equipment																				
	High	-	-	-	-	-	164	577	-	-	741	949	811	-	-	1,760	1,395	1,147	-	-	2,542
	Medium	19.0	232.9	-	-	251.9	147	521	-	-	668	845	758	-	-	1,603	1,187	1,035	-	-	2,222
	Low	-	-	-	-	-	127	463	-	-	590	740	710	-	-	1,450	978	948	-	-	1,926
40	Waste, Scrap Materials																				
	High	-	-	-	-	-	-	-	1,095	-	1,095	-	-	2,367	-	2,367	-	-	4,559	-	4,559
	Medium	-	-	637.5	-	637.5	-	-	1,022	-	1,022	-	-	1,936	-	1,936	-	-	3,302	-	3,302
	Low	-	-	-	-	-	-	-	887	-	887	-	-	1,308	-	1,308	-	-	1,795	-	1,795
	Other ^{2/}																				
	High	-	-	-	-	-	564	135	-	-	699	1,634	179	-	-	1,813	4,961	536	-	-	5,497
	Medium	318.9	197.9	-	-	516.8	502	120	-	-	622	1,188	129	-	-	1,317	3,146	337	-	-	3,483
	Low	-	-	-	-	-	438	104	-	-	542	687	74	-	-	761	1,153	120	-	-	1,273
	TOTAL																				
	High	-	-	-	-	-	7,600	4,774	11,440	15,939	39,753	24,368	6,345	27,037	21,406	79,156	42,587	11,097	49,468	29,767	132,919
	Medium	2,809.2	3,687.7	5,027.6	15,053.6	26,578.1	6,441	3,988	8,907	14,639	33,975	19,511	4,763	17,708	16,985	58,967	32,712	7,622	29,477	22,784	92,595
	Low	-	-	-	-	-	5,392	3,327	6,361	8,246	23,326	15,096	3,413	8,814	3,288	30,611	24,439	4,742	12,071	2,553	43,805

^{1/} Reflects the summation of Imports, Exports, Receipts, and Shipments

^{2/} Includes Ordnance and Accessories (19); Instruments, Photographic, etc (38); Misc. Manufactured Products (39); and Special Items (41).

-- Discrepancies between tables are due to rounding errors

TABLE XXVII
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR DELTA AREA 1/

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products	-	-	-	-	-	194	67	2,019	-	2,086	256	85	2,661	-	2,746	365	117	3,701	-	3,818
	High	-	-	-	-	-	125	41	1,279	-	1,320	155	49	1,600	-	1,649	210	65	2,120	-	2,185
	Medium	65.0	11.2	365.6	-	376.8	56	16	540	-	556	55	15	540	-	555	55	15	540	-	555
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Metallic Ores	-	-	-	-	-	-	-	365	-	365	-	-	576	-	576	-	-	999	-	999
	High	-	-	-	-	-	-	-	280	-	280	-	-	269	-	269	-	-	474	-	474
	Medium	-	-	23.5	-	23.5	-	-	166	-	166	-	-	Neg	-	Neg	-	-	39	-	39
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11 & 14	Non-Metallic Minerals & Coal	-	-	-	-	-	8	-	870	-	870	16	-	2,316	-	2,316	50	-	4,845	-	4,845
	High	-	-	-	-	-	8	-	741	-	741	14	-	1,357	-	1,357	27	-	2,343	-	2,343
	Medium	-	-	408.9	-	408.9	4	-	576	-	576	4	-	678	-	678	4	-	1,007	-	1,007
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 & 21	Food & Tobacco Products	-	-	-	-	-	199	28	627	131	786	450	58	1,223	350	1,631	749	95	1,595	429	2,119
	High	-	-	-	-	-	174	21	554	112	687	392	48	1,062	320	1,430	609	75	1,294	376	1,745
	Medium	46.0	47.2	201.1	75.3	323.6	149	15	480	93	588	332	38	902	296	1,236	469	54	992	342	1,388
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22 & 23	Textiles & Apparel Products	-	-	-	-	-	6	-	-	-	0	22	-	-	-	0	29	-	-	-	0
	High	-	-	-	-	-	6	-	-	-	0	12	-	-	-	0	17	-	-	-	0
	Medium	3.5	1.3	-	-	1.3	5	-	-	-	0	4	-	-	-	0	4	-	-	-	0
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24 & 25	Lumber & Furniture Products	-	-	-	-	-	12	95	929	-	1,024	33	323	4,413	-	4,736	97	401	5,996	-	6,397
	High	-	-	-	-	-	7	56	562	-	618	23	162	2,299	-	2,461	75	203	2,971	-	3,174
	Medium	2.2	106.0	513.8	-	619.8	2	15	144	-	159	11	1	Neg	-	1	48	5	Neg	-	5
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XXVII
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR DELTA AREA 1/

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972			TOTAL	1980			TOTAL	2000			TOTAL	2020			TOTAL
		General Cargo Container/ LASH	Break 2/ Bulk	Dry Bulk		General Cargo Container/ LASH	Break 2/ Bulk	Dry Bulk		General Cargo Container/ LASH	Break 2/ Bulk	Dry Bulk		General Cargo Container/ LASH	Break 2/ Bulk	Dry Bulk	
26 & 27	Pulp, Paper, & Printed Matter																
	High	-	-	-	-	1	8	-	8	2	12	-	12	7	18	-	18
	Medium	-	14.5	-	92.2	Neg	5	-	5	2	8	-	8	6	12	-	12
	Low	-	-	-	-	Neg	1	-	1	1	Neg	-	Neg	4	Neg	-	Neg
28	Chemicals & Allied Products																
	High	-	-	-	-												
	Medium	.6	7.2	126.5	227.7	41	22	286	1,590	129	32	1,108	1,871	188	43	1,990	4,976
	Low	-	-	-	-	33	22	253	1,578	74	32	798	1,813	103	43	1,344	4,137
						26	22	219	223	19	32	466	400	13	43	656	1,354
29	Petroleum Products																
	High	-	-	-	-	-	-	-	5,746	-	-	-	9,807	-	-	-	13,173
	Medium	-	-	-	1,076.7	-	-	-	5,650	-	-	-	9,231	-	-	-	12,430
	Low	-	-	-	-	-	-	-	1,300	-	-	-	293	-	-	-	1
30	Rubber & Plastic Products																
	High	-	-	-	-	1	-	-	0	4	-	-	0	11	-	-	0
	Medium	-	.3	-	.3	1	-	-	0	3	-	-	0	7	-	-	0
	Low	-	-	-	-	1	-	-	0	2	-	-	0	3	-	-	0
31	Leather Products																
	High	-	-	-	-	9	-	-	0	12	-	-	0	16	-	-	0
	Medium	.8	.4	-	.4	7	-	-	0	12	-	-	0	16	-	-	0
	Low	-	-	-	-	6	-	-	0	12	-	-	0	16	-	-	0

TABLE XXVII
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR DELTA AREA 1/
(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
		Container/ LASH	Break 2/ Bulk				Container/ LASH	Break 2/ Bulk				Container/ LASH	Break 2/ Bulk				Container/ LASH	Break 2/ Bulk			
32	Stone, Clay, Glass Products	-	-	-	-	-	4	-	-	-	0	8	-	-	-	0	15	-	-	-	0
	High	-	-	-	-	-	4	-	-	-	0	6	-	-	-	0	8	-	-	-	0
	Medium	1.3	1.7	-	-	1.7	4	-	-	-	0	4	-	-	-	0	4	-	-	-	0
	Low	-	-	-	-	-	2	-	-	-	0	-	-	-	-	0	-	-	-	-	0
33	Primary Metal Products	-	-	-	-	-	8	133	1,091	-	1,224	32	348	2,346	-	2,694	34	634	4,101	-	4,735
	High	-	-	-	-	-	8	122	961	-	1,083	28	282	1,740	-	2,022	34	476	2,752	-	3,228
	Medium	-	174.2	446.9	-	621.1	7	112	832	-	944	22	207	1,133	-	1,340	34	321	1,403	-	1,724
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Fabricated Metal Products	-	-	-	-	-	3	-	-	-	0	4	-	-	-	0	5	-	-	-	0
	High	-	-	-	-	-	3	-	-	-	0	4	-	-	-	0	5	-	-	-	0
	Medium	1.6	.7	-	-	.7	2	-	-	-	0	3	-	-	-	0	4	-	-	-	0
	Low	-	-	-	-	-	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0
35	Machinery, Except Electrical	-	-	-	-	-	9	5	-	-	5	31	8	-	-	8	42	18	-	-	18
	High	-	-	-	-	-	9	4	-	-	4	31	8	-	-	8	42	16	-	-	16
	Medium	-	2.7	-	-	2.7	8	4	-	-	4	31	7	-	-	7	42	12	-	-	12
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Electrical Machinery	-	-	-	-	-	3	7	-	-	7	13	6	-	-	6	22	4	-	-	4
	High	-	-	-	-	-	3	6	-	-	6	13	6	-	-	6	22	4	-	-	4
	Medium	5.8	1.3	-	-	1.3	3	5	-	-	5	13	6	-	-	6	22	4	-	-	4
	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE XXVII
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
PROJECTED RANGE OF WATERBORNE COMMERCE MOVEMENTS
SUMMARY TABLE FOR DELTA AREA ^{1/}

(Thousands of short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL	General Cargo		Dry Bulk	Liquid Bulk	TOTAL
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
37	Transportation Equipment																				
	High	-	-	-	-	-	1	5	-	-	5	2	10	-	-	10	3	14	-	-	14
	Medium	-	2.0	-	-	2.0	1	5	-	-	5	1	10	-	-	10	2	13	-	-	13
	Low	-	-	-	-	-	Neg	3	-	-	3	Neg	9	-	-	9	Neg	12	-	-	12
40	Waste, Scrap Materials																				
	High	-	-	-	-	-	1	-	196	-	196	5	-	474	-	474	14	-	802	-	802
	Medium	-	-	72.2	-	72.2	1	-	188	-	188	3	-	425	-	425	9	-	662	-	662
	Low	-	-	-	-	-	Neg	-	113	-	113	2	-	161	-	161	6	-	209	-	209
	Other ^{3/}																				
	High	-	-	-	-	-	3	-	-	-	0	6	-	-	-	0	20	-	-	-	0
	Medium	-	2.6	-	-	2.6	2	-	-	-	0	5	-	-	-	0	15	-	-	-	0
	Low	-	-	-	-	-	1	-	-	-	0	4	-	-	-	0	9	-	-	-	0
	TOTAL																				
	High	-	-	-	-	-	503	370	6,383	7,467	14,220	1,025	882	15,117	12,028	28,027	1,667	1,344	24,029	16,545	41,918
	Medium	126.8	373.3	2,158.5	1,323.7	3,855.5	392	282	4,818	7,340	12,440	778	605	9,550	11,364	21,519	1,207	907	13,960	15,556	30,423
	Low	-	-	-	-	-	273	193	3,070	1,616	4,879	519	315	3,880	989	5,184	742	466	4,846	998	6,310

^{1/} Reflects the summation of Imports, Exports, Receipts, and Shipments.

^{2/} Container/LASH cargoes constitute internal shipments between Delta and San Francisco Bay Ports. They are consequently excluded from the Delta totals.

^{3/} Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured Products (39); and Special Items (41).

- Discrepancies between tables are due to rounding errors.

NOTE: "Neg" means negligible.

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APPENDIX A

Medium Level Projections for
the San Francisco Bay Region and the Delta Area

TABLE A-1
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
IMPORTS FOR TOTAL SAN FRANCISCO BAY REGION

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products	5.5	285.1	-	-	290.6	32	126	-	-	158	Neg	Neg	-	-	Neg	Neg	Neg	-	-	Neg
08	Forest Products	7.5	-	-	-	7.5	21	-	-	-	21	61	-	-	-	61	83	-	-	-	83
10	Metallic Ores	-	-	51.6	-	51.6	-	-	71	-	71	-	-	292	-	292	-	-	1,195	-	1,195
11 & 14	Non-Metallic Minerals & Coal	-	-	439.7	-	439.7	-	-	390	-	390	-	-	937	-	937	-	-	2,259	-	2,259
20 & 21	Food, Tobacco Products	141.5	318.0	47.0	93.1	599.6	492	464	93	236	1,285	3,526	605	221	780	5,132	4,410	763	188	894	6,255
22 & 23	Textiles & Apparel Products	45.8	.4	-	-	46.2	38	-	-	-	38	35	-	-	-	35	32	-	-	-	32
24 & 25	Lumber & Furniture Products	47.6	17.5	-	-	65.1	28	4	-	-	32	12	1	-	-	13	5	Neg	-	-	5
26 & 27	Pulp, Paper & Printed Matter	16.9	205.8	-	141.3	364.0	96	187	-	-	283	514	188	-	-	702	991	349	-	-	1,340
28	Chemicals and Allied Products	9.2	39.3	32.6	19.7	100.8	42	61	117	44	264	221	84	395	131	831	262	122	692	165	1,241
29	Petroleum Products	-	4.1	-	570.0	574.1	-	2	-	186	188	-	5	-	690	695	-	14	-	2,043	2,057
30	Rubber and Plastic Products	23.2	.2	-	-	23.4	38	-	-	-	38	94	-	-	-	94	177	-	-	-	177
31	Leather Products	18.8	.4	-	-	19.2	92	-	-	-	92	156	-	-	-	156	211	-	-	-	211
32	Stone, Clay, Glass Products	2.0	37.4	15.8	-	55.2	4	43	18	-	65	4	81	33	-	118	5	128	54	-	187
33	Primary Metal Products	286.2	346.4	166.2	-	798.8	970	553	390	-	1,913	4,539	904	1,404	-	6,847	5,517	1,088	1,703	-	8,308
34	Fabricated Metal Products	51.2	22.5	-	-	73.7	61	11	-	-	72	94	5	-	-	99	118	6	-	-	124
35	Machinery, Except Electrical	55.2	38.7	-	-	93.9	170	40	-	-	210	693	74	-	-	767	935	100	-	-	1,035
36	Electric Machinery	51.6	6.3	-	-	57.9	206	18	-	-	224	446	29	-	-	475	605	36	-	-	641
37	Transportation Equipment	12.7	154.7	-	-	167.4	108	435	-	-	543	679	688	-	-	1,367	917	928	-	-	1,845
40	Waste, Scrap Materials	-	-	5.7	-	5.7	-	-	23	-	23	-	-	110	-	110	-	-	318	-	318
	Other ^{1/}	26.1	15.3	-	-	41.4	104	23	-	-	127	435	46	-	-	481	1,226	132	-	-	1,358
TOTAL		801.0	1,492.1	758.6	824.1	3,875.8	2,502	1,967	1,102	466	6,037	11,509	2,710	3,392	1,601	19,212	15,494	3,666	6,409	3,102	28,671

^{1/} Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured Products (39); and Special Items (41).

NOTE: "Neg" means negligible.

TABLE A-2
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
EXPORTS FOR TOTAL SAN FRANCISCO BAY REGION

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage
01	Farm Products	120.0	37.4	344.5	-	501.9	323	73	1,700	-	2,096	407	92	2,143	-	2,642	540	123	2,840	-	3,503
08	Forest Products	.3	-	-	-	.3	2	-	-	-	2	2	-	-	-	2	1	-	-	-	1
10	Metallic Ores	-	-	31.5	-	31.5	-	-	320	-	320	-	-	278	-	278	-	-	342	-	342
11 & 14	Non-Metallic Minerals & Coal	-	-	546.4	-	546.4	13	-	658	-	671	18	-	1,403	-	1,421	34	-	3,656	-	3,690
20 & 21	Food, Tobacco Products	322.1	237.9	228.3	21.8	810.1	881	211	650	39	1,781	1,261	169	1,138	42	2,610	1,711	234	1,437	55	3,437
22 & 23	Textiles & Apparel Products	15.6	.9	-	-	16.5	19	-	-	-	19	68	-	-	-	68	99	-	-	-	99
24 & 25	Lumber & Furniture Products	18.8	137.0	513.8	-	669.6	37	81	563	-	681	227	208	2,299	-	2,734	447	273	2,971	-	3,691
26 & 27	Pulp, Paper, & Printed Matter	16.9	3.5	-	1.2	21.6	29	3	-	-	32	78	4	-	-	82	199	10	-	-	209
28	Chemicals and Allied Products	28.1	132.8	69.2	50.0	280.1	101	101	93	711	1,006	492	99	308	1,510	2,409	782	82	458	2,218	3,540
29	Petroleum Products	-	3.8	-	232.2	236.0	-	Neg	-	Neg	Neg	-	Neg	-	Neg	Neg	-	Neg	-	Neg	Neg
30	Rubber and Plastic Products	4.6	.1	-	-	4.7	9	-	-	-	9	35	-	-	-	35	155	-	-	-	155
31	Leather Products	3.1	-	-	-	3.1	3	-	-	-	3	9	-	-	-	9	35	-	-	-	35
32	Stone, Clay Glass Products	-	12.5	-	-	12.5	-	41	-	-	41	-	60	-	-	60	-	78	-	-	78
33	Primary Metal Products	22.5	34.8	771.7	-	829.0	47	58	1,421	-	1,526	121	90	2,610	-	2,821	198	198	4,217	-	4,613
34	Fabricated Metal Products	6.7	3.0	-	-	9.7	8	1	-	-	9	8	Neg	-	-	8	10	1	-	-	11
35	Machinery, Except Electrical	43.7	30.0	-	-	73.7	111	29	-	-	140	207	24	-	-	231	289	33	-	-	322
36	Electrical Machinery	20.1	2.2	-	-	22.3	33	2	-	-	35	98	5	-	-	103	128	7	-	-	135
37	Transportation Equipment	2.3	24.6	-	-	26.9	22	41	-	-	63	99	33	-	-	132	127	43	-	-	170
40	Waste, Scrap Materials	-	-	626.2	-	626.2	-	-	973	-	973	-	-	1,784	-	1,784	-	-	2,916	-	2,916
	Other ^{1/}	9.7	14.4	-	-	24.1	13	1	-	-	14	1	Neg	-	-	1	Neg	Neg	-	-	Neg
TOTAL		634.5	674.9	3,131.6	305.2	4,746.2	1,651	642	6,378	750	9,421	3,131	784	11,963	1,552	17,430	4,755	1,082	18,837	2,273	26,947

^{1/}Includes Ordnance and Accessories (19); Instruments, Photographic, etc (38); Misc. Manufactured Products (39); and Special Items (41).

NOTE "Neg" means negligible.

TABLE A-3
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
COASTWISE RECEIPTS FOR TOTAL SAN FRANCISCO BAY REGION
(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo Container/ LASH	Break Bulk	Dry Bulk	Liquid Bulk	Total Tonnage
01	Farm Products	26.5	.5	22.0	-	49.0	13	-	10	-	23	Neg	-	Neg	-	Neg	Neg	-	Neg	-	Neg
08	Forest Products	-	-	-	-	-	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1
10	Metallic Ores	-	-	-	-	-	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1
11 & 14	Non-Metallic Minerals & Coal	.1	.3	146.8	-	147.2	Neg	Neg	384	-	384	1	1	584	-	586	4	4	621	-	629
20 & 21	Food, Tobacco Products	323.7	80.9	764.0	141.7	1,310.3	340	38	715	143	1,236	658	34	1,305	280	2,277	1,473	77	2,931	634	5,115
22 & 23	Textiles & Apparel Products	2.4	-	-	-	2.4	20	-	-	-	20	55	-	-	-	55	233	-	-	-	233
24 & 25	Lumber & Furniture Products	17.8	2.0	-	-	19.8	8	Neg	-	-	8	Neg	Neg	-	-	Neg	Neg	Neg	-	-	Neg
26 & 27	Pulp, Paper, & Printed Matter	6.1	1.4	-	.3	7.8	139	15	-	-	154	394	23	-	-	417	1,523	87	-	-	1,610
28	Chemicals and Allied Products	130.7	111.3	24.7	139.9	406.6	285	155	43	777	1,260	756	133	95	476	1,460	1,479	262	194	1,041	2,976
29	Petroleum Products	-	19.6	-	4055.4	4,075.0	-	11	-	6,392	6,403	-	2	-	8,776	8,778	-	Neg	-	11,744	11,744
30	Rubber and Plastic Products	1.4	-	-	-	1.4	Neg	-	-	-	Neg	6	-	-	-	6	43	-	-	-	43
31	Leather Products	3.3	-	-	-	3.3	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1
32	Stone, Clay, Glass Products	-	52.3	-	-	52.3	-	63	-	-	63	-	160	-	-	160	-	1,146	-	-	1,146
33	Primary Metal Products	1.0	334.1	7.5	-	342.6	41	163	5	-	209	98	98	4	-	200	89	89	4	-	182
34	Fabricated Metal Products	27.3	11.7	-	-	39.0	11	2	-	-	13	20	1	-	-	21	38	3	-	-	41
35	Machinery, Except Electrical	2.6	1.8	-	-	4.4	6	1	-	-	7	38	-	-	-	38	134	-	-	-	134
36	Electrical Machinery	4.1	1.2	-	-	5.3	1	-	-	-	1	Neg	-	-	-	Neg	Neg	-	-	-	Neg
37	Transportation Equipment	-	16.8	-	-	16.8	-	14	-	-	14	-	15	-	-	15	-	17	-	-	17
40	Waste, Scrap Materials	-	-	4.6	-	4.6	-	-	6	-	6	-	-	15	-	15	-	-	33	-	33
	Other ^{1/}	52.8	32.3	-	-	85.1	19	5	-	-	24	57	6	-	-	63	339	30	-	-	369
	TOTAL	599.8	666.2	969.6	4,337.3	6,572.9	886	467	1,163	7,312	9,828	2,086	473	2,003	9,532	14,094	5,358	1,715	3,783	13,419	24,275

^{1/} Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured Products (39); and Special Items (41).

"Neg" means negligible.

TABLE A-4
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
COASTWISE SHIPMENTS FOR TOTAL SAN FRANCISCO BAY REGION
(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000			2020						
		General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Total Tonnage
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products	52.6	-	156.5	-	209.1	65	-	193	-	258	76	-	226	-	302	101	-	304	-	405
08	Forest Products	.4	-	-	-	.4	1	-	-	-	1	1	-	-	-	1	1	-	-	-	1
10	Metallic Ores	-	-	.2	-	.2	-	-	2	-	2	-	-	2	-	2	-	-	2	-	2
11 & 14	Non-Metallic Minerals & Coal	-	-	5.6	-	5.6	-	-	9	-	9	-	-	9	-	9	-	-	9	-	9
20 & 21	Food, Tobacco Products	272.8	66.5	-	42.9	382.2	452	52	36	14	554	545	29	80	16	670	626	30	93	17	766
22 & 23	Textiles & Apparel Products	17.0	-	-	-	17.0	8	-	-	-	8	8	-	-	-	8	8	-	-	-	8
24 & 25	Lumber & Furniture Products	27.8	18.6	-	-	46.4	76	19	-	-	95	382	42	-	-	424	1,704	189	-	-	1,893
26 & 27	Pulp, Paper, & Printed Matter	43.8	8.8	-	.2	52.8	75	9	-	-	84	361	19	-	-	380	1,640	87	-	-	1,727
28	Chemicals and Allied Products	46.9	43.6	-	34.6	125.1	240	62	-	239	541	397	48	-	292	737	526	64	-	347	937
29	Petroleum Products	-	448.2	-	9,509.3	9,957.5	-	276	-	5,858	6,134	-	188	-	3,992	4,180	-	171	-	3,626	3,797
30	Rubber and Plastic Products	8.1	-	-	-	8.1	8	-	-	-	8	22	-	-	-	22	73	-	-	-	73
31	Leather Products	11.0	-	-	-	11.0	2	-	-	-	2	4	-	-	-	4	5	-	-	-	5
32	Stone, Clay, Glass Products	-	65.7	-	-	65.7	-	353	-	-	353	-	353	-	-	353	-	353	-	-	353
33	Primary, Metal Products	16.9	16.9	4.5	-	38.3	24	11	5	-	40	31	5	5	-	41	32	6	5	-	43
34	Fabricated Metal Products	13.3	5.7	-	-	19.0	22	4	-	-	26	38	2	-	-	40	63	3	-	-	66
35	Machinery, Except Electrical	8.3	5.6	-	-	13.9	13	3	-	-	16	19	2	-	-	21	25	3	-	-	28
36	Electrical Machinery	20.7	2.2	-	-	22.9	33	2	-	-	35	139	7	-	-	146	579	30	-	-	609
37	Transportation Equipment	4.0	36.8	-	-	40.8	17	31	-	-	48	67	22	-	-	89	142	48	-	-	190
40	Waste, Scrap Materials	-	-	1.0	-	1.0	-	-	20	-	20	-	-	27	-	27	-	-	35	-	35
	Other 1/	230.3	135.9	-	-	366.2	366	91	-	-	457	695	77	-	-	772	1,580	176	-	-	1,756
	TOTAL	773.9	854.5	167.8	9,587.0	11,383.2	1,402	913	265	6,111	8,691	2,785	794	349	4,300	8,228	7,105	1,160	448	3,990	12,703

1/ Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured Products (39); and Special Items (41).

"Neg" means negligible.

TABLE A-5
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
IMPORTS FOR DELTA AREA

CODE	COMMODITY GROUP	1972					(Thousands of Short Tons)					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products	-	2.2	-	-	2.2	1	2	-	-	2	Neg	Neg	-	-	Neg	Neg	Neg	-	-	Neg
10	Metallic Ores	-	-	23.5	-	23.5	-	-	28	-	28	-	-	50	-	50	-	-	205	-	205
11 & 14	Non-Metallic Minerals & Coal	-	-	173.3	-	173.3	-	-	192	-	192	-	-	461	-	461	-	-	1,111	-	1,111
20 & 21	Food, Tobacco Products	11.3	14.4	47.0	24.6	86.0	29	-	91	93	184	159	-	404	286	690	249	-	487	299	786
22 & 23	Textiles & Apparel Products	3.5	.4	-	-	.4	3	-	-	-	0	2	-	-	-	0	2	-	-	-	0
24 & 25	Lumber & Furniture Products	1.8	.5	-	-	.5	-	1	-	-	1	-	-	-	-	Neg	-	Neg	-	-	Neg
26 & 27	Pulp, Paper, & Printed Matter	-	14.4	-	77.7	92.1	-	5	-	-	5	-	8	-	-	8	-	12	-	-	12
28	Chemicals and Allied Products	.3	-	32.6	-	32.6	-	-	117	-	117	-	-	395	-	395	-	-	692	-	692
30	Rubber and Plastic Products	-	.2	-	-	.2	1	-	-	-	0	2	-	-	-	0	4	-	-	-	0
31	Leather Products	.8	.4	-	-	.4	7	-	-	-	0	12	-	-	-	0	16	-	-	-	0
32	Stone, Clay, Glass Products	1.3	1.3	-	-	1.3	3	-	-	-	0	5	-	-	-	0	7	-	-	-	0
33	Primary Metal Products	-	3.6	-	-	3.6	8	31	-	-	31	28	112	-	-	112	34	135	-	-	135
34	Fabricated Metal Products	1.6	.6	-	-	.6	3	-	-	-	0	4	-	-	-	0	5	-	-	-	-
35	Machinery, Except Electrical	-	1.9	-	-	1.9	9	-	-	-	0	31	-	-	-	0	42	-	-	-	0
36	Electrical Machinery	5.8	.5	-	-	.5	3	6	-	-	6	13	6	-	-	6	22	4	-	-	4
37	Transportation Equipment	-	1.1	-	-	1.1	-	4	-	-	4	-	9	-	-	9	-	12	-	-	12
40	Waste, Scrap Materials	-	-	-	-	-	1	-	-	-	0	3	-	-	-	0	9	-	-	-	0
	Other <u>2/</u>	-	.3	-	-	.3	1	-	-	-	0	5	-	-	-	0	15	-	-	-	0
	TOTAL	26.4	41.8	276.4	102.3	420.5	69	49	428	93	570	264	135	1,310	286	1,371	405	163	2,495	299	2,957

1/ Constitutes internal shipments to Delta Ports from San Francisco Bay Ports.

2/ Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured products (39); and Special Items (41).

NOTE: "Neg" means negligible.

TABLE A-6
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
EXPORTS FOR DELTA AREA
(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
01	Farm Products	65.0	9.0	251.3	-	260.3	104	39	1,157	-	1,196	132	49	1,457	-	1,506	174	65	1,933	-	1,998
10	Metallic Ores	-	-	-	-	-	-	-	252	-	252	-	-	219	-	219	-	-	269	-	269
11 & 14	Non-Metallic Minerals & Coal	-	-	88.8	-	88.8	8	-	171	-	171	14	-	322	-	322	27	-	622	-	622
20 & 21	Food & Tobacco Products	34.7	32.8	154.1	-	186.9	107	21	440	-	461	190	48	594	-	642	297	75	724	-	799
22 & 23	Textiles and Apparel Products	-	.9	-	-	.9	3	-	-	-	-	10	-	-	-	-	15	-	-	-	-
24 & 25	Lumber & Furniture Products	.4	105.5	513.8	-	619.3	5	54	562	-	616	12	161	2,299	-	2,460	27	198	2,971	-	3,169
26 & 27	Pulp, Paper, & Printed Matter	-	.1	-	-	.1	Neg	-	-	-	-	1	-	-	-	-	3	-	-	-	-
28	Chemicals and Allied Products	.3	.4	69.2	-	69.6	33	Neg	93	625	718 ^{3/}	74	Neg	308	1,256	1,564 ^{3/}	103	Neg	458	1,848	2,306 ^{3/}
30	Rubber and Plastic Products	-	.1	-	-	.1	Neg	-	-	-	-	1	-	-	-	-	3	-	-	-	-
32	Stone, Clay, Glass Products	-	.4	-	-	.4	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-
33	Primary Metal Products	-	1.3	446.9	-	448.2	-	51	961	-	1,012	-	131	1,740	-	1,871	-	306	2,752	-	3,058
34	Fabricated Metal Products	-	.1	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Machinery, Except Electrical	-	.8	-	-	.8	-	4	-	-	4	-	6	-	-	6	-	9	-	-	9
36	Electrical Machinery	-	Neg	-	-	Neg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	Transportation Equipment	-	Neg	-	-	Neg	1	-	-	-	-	1	-	-	-	-	2	-	-	-	-
40	Waste, Scrap Materials	-	-	72.2	-	72.2	-	-	188	-	188	-	-	425	-	425	-	-	662	-	662
	Other ^{2/}	-	2.3	-	-	2.3	1	-	-	-	-	Neg	-	-	-	-	Neg	-	-	-	-
	TOTAL	100.4	153.7	1,596.3	-	1,750.0	263	169	3,824	625	4,618	436	395	7,364	1,256	9,015	652	653	10,391	1,848	12,892

^{1/} Constitutes an internal shipment from Delta Ports to San Francisco Bay Ports.

^{2/} Includes Ordnance and Accessories (19); Instruments, Photographic, etc. (38); Misc. Manufactured Products (39); and Special Items (41).

^{3/} Projection includes caustic and styrene products associated with proposed petro-chemical facility which may be in operation between 1980 and 1983. These products are reflected in the Liquid Bulk category.

NOTE: "Neg" means negligible.

TABLE 4-7
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
COASTWISE RECEIPTS FOR DELTA AREA

(Thousands of Short Tons)

CODE	COMMODITY GROUP	1972					1980					2000					2020				
		General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo		Dry Bulk	Liquid Bulk	Net Tonnage
		Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk				Container/ LASH	Break Bulk			
11 & 14	Non-Metallic Mineral & Coal	-	-	146.8	-	146.8	-	-	378	-	378	-	-	574	-	574	-	-	610	-	610
20 & 21	Food, Tobacco Products	-	-	-	17.6	17.6	-	-	-	19	19	-	-	-	34	34	-	-	-	77	77
28	Chemicals and Allied Products	-	-	24.7	60.2	84.9	-	-	43	728	771 ^{3/}	-	-	95	285	380	-	-	194	582	776
29	Petroleum Products ^{2/}	-	-	-	308.9	308.9	-	-	-	4,477	4,477 ^{4/}	-	-	-	8,432	8,432 ^{4/}	-	-	-	11,704	11,704 ^{4/}
33	Primary Metal Products	-	169.3	-	-	169.3	-	39	-	-	39	-	38	-	-	38	-	34	-	-	34
35	Machinery, Except Electrical	-	-	-	-	-	-	Neg	-	-	Neg	-	2	-	-	2	-	7	-	-	7
36	Electrical Machinery	-	.8	-	-	.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	Transportation Equipment	-	.8	-	-	.8	-	1	-	-	1	-	1	-	-	1	-	1	-	-	1
	TOTAL	-	170.9	171.5	386.7	729.1	-	40	421	5,224	5,685	-	41	669	8,751	9,461	-	42	804	12,363	13,209

^{1/}Constitutes an internal shipment to Delta Ports from San Francisco Bay Ports.

^{2/}Petroleum Products may be either an import or coastwise receipt. This analysis credits all movements of this commodity to coastwise receipts.

^{3/}Projection includes receipts of 550,000 tons of ethylbenzene and cumene for proposed petro-chemical facility. The receipt of these two chemicals is temporary and will cease when the proposed facility is in full operation.

^{4/}Projection includes naptha associated with proposed petro-chemical facilities which may be in operation between 1980 and 1983.

NOTE: "Neg" means negligible.

TABLE A-8
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
Medium Level Projections of
COASTWISE SHIPMENTS FOR DELTA AREA

		(Thousands of Short Tons)																			
		1972					1980					2000					2020				
CODE	COMMODITY GROUP	General Cargo Container/ LASH	1/ Break Bulk	Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo Container/ LASH	1/ Break Bulk	Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo Container/ LASH	1/ Break Bulk	Dry Bulk	Liquid Bulk	Net Tonnage	General Cargo Container/ LASH	1/ Break Bulk	Dry Bulk	Liquid Bulk	Net Tonnage
01	Farm Products	-	-	114.3	-	114.3	20	-	122	-	122	23	-	143	-	143	36	-	187	-	187
20 &																					
21	Food, Tobacco Products	-	-	-	33.1	33.1	38	-	23	-	23	43	-	64	-	64	63	-	83	-	83
24 &																					
25	Lumber & Furniture Products	-	-	-	-	-	2	1	-	-	1	11	1	-	-	1	48	5	-	-	5
26 &																					
27	Pulp, Paper, & Printed Matter	-	-	-	-	-	Neg	Neg	-	-	Neg	1	Neg	-	-	Neg	3	Neg	-	-	Neg
28	Chemicals and Allied Products	-	6.8	-	33.8	40.6	-	22	-	225	247 2/	-	32	-	272	304 2/	-	43	-	320	363 2/
29	Petroleum Products	-	-	-	767.8	767.8	-	-	-	1,173	1,173	-	-	-	799	799	-	-	-	726	726
33	Primary Metal Products	-	-	-	-	-	-	1	-	-	1	-	1	-	-	1	-	1	-	-	1
37	Transportation Equipment	-	.1	-	-	.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	-	6.9	114.3	834.7	955.9	60	24	145	1,398	1,567	78	34	207	1,071	1,312	150	49	270	1,046	1,365

1/ Constitutes an internal shipment from Delta Ports to San Francisco Bay Ports

2/ Projection includes tonnage of proposed petro-chemical facilities which may be in operation between 1980 and 1983. This amounts to 125,000 tons of styrene.

NOTE: "Neg" means negligible.

APPENDIX B

Final Projection Equations
and Regression Statistics

APPENDIX B

This appendix presents tables of the final equations selected (by movement and commodity group) and resulting regression statistics used in the multiple regression analysis of waterborne commerce for the San Francisco Bay Region. The tables show the final equation form (i.e., linear or log; real or per capita), the constant term, the independent variables (including their coefficients and standard errors) used in the final equation, the F-Statistic, and the Durbin-Watson Statistic.

Below is a list of the independent variables and their respective abbreviations as shown in the tables.

<u>Abbreviation</u>	<u>Independent Variable</u>
WPI	World Price Index
DPI	Domestic Price Index
PI	Personal Income
POP	Population
EPI	Export Price Index
WI	Total World Imports

TABLE B-1
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
IMPORT REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Real or Per Capita	Constant Term	Coefficients of Independent Variables				POP	F-Statistic	Durbin Watson Statistic
					Time	WPI	DPI	PI			
01	Farm Products	Linear	Real	9.542E+7 (1.781E+7)	-4.893E+4 (9.247E+3)	-2.850E+5 (8.267E+4)			.231 (6.074E-2)	20.736	1.303
08	Forest Products	Linear	Per Capita	.200 (9.584E-2)	-1.053E-4 (5.003E-5)			1.980E-6 (6.983E-7)		8.617	1.112
10	Metallic Ores	Linear	Real	1.112E+8 (3.691E+7)	-5.759E+4 (1.901E+4)	-3.027E+5 (1.979E+5)	6.013E+5 (2.494E+5)	1.563E-2 (1.681E-2)	.233 (8.664E-2)	6.964	2.133
11 & 14	Non Metallic Minerals & Coal	Linear	Real	1.265E+8 (7.711E+7)	-6.608E+4 (4.020E+4)	-2.029E+5 (2.271E+5)	6.722E+5 (8.433E+5)	1.546E-2 (3.132E-2)	.450 (.178)	10.553	1.518
20 & 21	Food & Tobacco Products	Log	Real	-1.045E+2 (1.614E+1)	5.598E-2 (8.215E-3)		7.581 (2.650)			80.899	2.556
22 & 23	Textiles & Apparel Products	Linear	Real	3.558E+5 (4.508E+5)	-1.604 E+2 (2.296E+2)					.488	1.136
24 & 25	Lumber & Furniture Products	Log	Real	5.383E+1 (4.518E+1)	-3.279E-2 (3.490E-2)	-1.062 (2.615)	.971 (2.577)		2.260 (3.859)	.775	1.076
26 & 27	Pulp, Paper, & Printed Matter	Linear	Real	2.351E+8 (1.363E+8)	-1.250E+5 (7.003E+4)		3.476E+6 (1.764E+6)	3.341E-3 (5.013E-2)	1.184 (.267)	5.738	1.297
28	Chemicals & Allied Products	Linear	Per Capita	1.577 (1.327)	-8.276E-4 (6.927E-4)			1.626E-5 (9.669E-6)		3.509	.789
29	Petroleum Products	Linear	Real	6.396E+8 (1.785E+8)	-3.322E+5 (9.273E+4)				2.241 (.601)	7.323	1.054

Numbers in parentheses are standard errors.

TABLE B-1
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
IMPORT REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Real or Per Capita	Constant Term		Coefficients of Independent Variables				F-Statistic	Durbin Watson Statistic
					Time	WPI	DPI	PI	PCP		
30	Rubber and Plastic Products	Linear	Per Capita	-.441 (.197)	2.275E-4 (9.829E-5)	-8.554E-3 (4.235E-3)	5.127E-3 (3.794E-3)			28.946	1.561
31	Leather Products	Log	Real	-1.197E+2 (4.946E+1)	4.153E-2 (3.524E-2)				6.151 (2.975)	190.159	2.226
32	Stone, Clay, Glass Products	Log	Real	-1.835 (6.353E+1)	-6.263E-3 (3.903E-2)	-3.424 (2.045)	4.172 (2.838)	.301 (2.308)	2.436 (2.454)	10.091	2.167
33	Primary Metal Products	Linear	Per Capita	8.284 (5.455)	-4.451E-3 (2.815E-3)	-.138 (3.692E-2)	.141 (8.268E-2)	1.408E-4 (3.582E-5)		59.270	1.588
34	Fabricated Metal Products	Linear	Real	-1.789E+6 (3.771E+6)	9.923E+2 (1.840E+3)	-1.066E+5 (1.698E+5)				3.295	1.056
35	Machinery, Except Electrical	Log	Per Capita	-1.350E+2 (1.335E+1)	6.739E-2 (6.803E-3)					98.123	1.054
36	Electrical Machinery	Linear	Per Capita	1.541 (.679)	-8.043E-4 (3.496E-4)	-3.860E-2 (1.357E-2)	1.463E-2 (1.323E-2)	1.895E-5 (5.272E-6)		32.943	2.017
37	Transportation Equipment	Linear	Per Capita	.219 (1.958)	-1.226E-6 (1.007E-3)	-2.130E-2 (4.363E-2)	.115 (6.439E-2)	3.749E-5 (1.683E-5)		11.017	.616
40	Waste and Scrap Materials	Linear	Real	4.942E+6 (6.742E+6)	-2.688 E+3 (3.426 E+3)		1.730E+5 (1.120E+5)	2.442E-3 (2.032E-3)	1.879E-2 (9.727E-3)	3.945	2.439
	Other	Linear	Per Capita	1.687 (.790)	-8.763E-4 (4.053E-4)	-7.895E-3 (1.548E-2)		1.312E-5 (4.749E-6)		3.471	2.326

Numbers in parentheses are standard errors.

TABLE B-2
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
EXPORT REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Constant Term	Coefficients of Independent Variables				F-Statistic	Durbin Watson Statistic
				Time	EPI	WPI	WI		
01	Farm Products	Linear	3.089E+7 (2.298E+7)	-1.491E+4 (1.201E+4)	-8.526E+3 (7.930E+3)			5.484	3.083
08	Forest Products	Linear	4.331E+5 (5.762E+5)	-2.087E+2 (2.864E+2)	-1.915E+2 (1.386E+2)			1.574	1.919
10	Metallic Ores	Linear	-1.032E+8 (1.122E+8)	6.356E+3 (5.795E+3)	-2.141E+4 (1.166E+4)		2.874E+3 (8.392E+3)	1.596	1.463
11 & 14	Non-Metallic Minerals & Coal	Linear	-1.299E+5 (4.035E+7)	6.940E+3 (2.071E+4)	-1.928E+4 (9.480E+3)		3.120E+3 (1.998E+3)	3.275	1.133
20 & 21	Food & Tobacco Products	Linear	-1.543E+8 (3.159E+7)	7.966E+4 (1.635E+4)	-2.111E+4 (7.904E+3)	6.460E+3 (3.306E+3)		33.243	2.100
22 & 23	Textiles & Apparel Products	Linear	6.199E+3 (1.615E+3)				1.037E+1 (3.395)	9.336	1.474
24 & 25	Lumber & Furniture Products	Linear	7.817E+7 (5.926E+7)	-4.029E+4 (3.043E+4)			1.748E+3 (7.940E+2)	7.819	3.236
26 & 27	Pulp, Paper & Printed Matter	Log	-1.898E+1 (3.413E+1)	1.861E-2 (1.816E-2)	-9.020 (.929)		1.791 (.575)	113.735	1.908
28	Chemicals & Allied Products	Log	1.521E+1 (4.653)		-6.613 (2.395)		1.340 (.166)	32.549	1.367
29	Petroleum Products	Linear	9.921E+7 (2.709E+7)	-4.877E+4 (1.402E+4)	-2.686E+4 (1.400E+4)			11.719	1.389

Numbers in parentheses are standard errors.

TABLE B-2
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
EXPORT REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Constant Term	Coefficients of Independent Variables				F-Statistic	Durbin Watson Statistic
				Time	EPI	WPI	WI		
30	Rubber and Plastic Products	Linear	4.145E+5 (3.584E+5)	-2.140E +2 (1.840E +2)			1.379E +1 (4.807)	25.753	1.049
31	Leather Products	Linear	1.755E+5 (9.399E+4)	-9.258E +1 (4.800E +1)		6.000E +1 (1.813E +1)	2.847 (2.022)	36.218	1.796
32	Stone, Clay, Glass Products	Log	1.576E+1 (5.298)		-9.651 (3.569)		2.896 (.749)	11.752	1.513
33	Primary Metal Products	Linear	-5.231E+7 (2.426E+7)	2.575E +4 (1.255E +4)		2.279E +4 (5.027E +3)		57.156	1.245
34	Fabricated Metal Products	Log	1.452E+2 (9.443E+1)	-7.505E-2 (5.003E-2)	-.983 (4.460)	.742 (4.842)	2.598 (1.584)	1.036	1.698
35	Machinery, Except Electrical	Linear	-8.847E+6 (1.450E+6)	4.539E +4 (7.385E +3)				37.782	.911
36	Electrical Machinery	Linear	-1.020E+3 (1.485E+3)				3.120E +1 (3.381)	85.157	1.421
37	Transportation Equipment	Linear	-2.099E+3 (5.377E+3)				5.717E +1 (1.224E +1)	21.807	1.209
40	Scrap and Waste Materials	Linear	-3.397E+7 (2.618E+7)	1.773E +4 (1.362E +4)	-1.330E+4 (6.600E+3)		4.583E +3 (1.860E +3)	22.833	1.906
	Other	Log	1.291E+2 (2.317E+1)	-6.387E-2 (1.373E-2)	-4.297 (2.693)	4.887 (1.676)		59.104	2.737

Numbers in parentheses are standard errors.

TABLE B-3
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
COASTWISE RECEIPTS REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Real or Per Capita	Coefficients of Independent Variables					F-Statistic	Durbin Watson Statistic	
		Constant	Term	Time	U.S.Shipments	PI	POP				
01	Farm Products	Linear	Per Capita	3.978E-1 (2.836E-1)		-2.036E-4 (1.458E-4)	2.900E-2 (1.744E-2)		1.404	2.132	
08	Forest Products	Linear	Real	1.944E+6 (1.814E+6)		-1.002E+3 (9.397E+2)	3.925E-2 (3.018E-2)	9.466E-4 (7.853E-4)	7.568E-4 (4.875E-3)	1.004	2.447
10	Metallic Ores	Linear	Per Capita	1.283E-1 (7.690E-2)		-6.658E-5 (4.036E-5)	2.941E-3 (4.326E-3)	7.056E-4 (6.848E-4)		2.175	1.724
11 & 14	Non-Metallic Minerals & Coal	Linear	Per Capita	1.089 (1.303)		-5.993E-4 (6.799E-4)	3.680E-4 (2.402E-3)	2.688E-2 (1.022E-2)		27.472	2.835
20 & 21	Food & Tobacco Products	Linear	Real	2.063E+8 (2.010E+8)		-1.070E+5 (1.041E+5)	2.447E-1 (1.937E-1)	3.706E-2 (6.587E-2)	5.451E-1 (6.081E-1)	1.074	2.296
22 & 23	Textiles & Apparel Products	Linear	Real	9.017E+6 (7.836E+5)		-4.636E+3 (4.041E+2)		4.264E-3 (4.703E-4)		188.412	1.574
24 & 25	Lumber & Furniture Products	Linear	Real	3.276E+7 (1.309E+7)		-1.706E+4 (6.792E+3)	1.892E-2 (1.271E-2)		1.247E-1 (4.388E-2)	7.889	1.902
26 & 27	Pulp, Paper, & Printed Matter	Linear	Per Capita	8.389 (5.816E-1)		-4.352E-3 (3.050E-4)		4.611E-2 (5.025E-3)		270.050	1.154
28	Chemicals & Allied Products	Linear	Real	1.220E+7 (4.111E+7)		-6.446E+3 (2.132E+4)		1.508E-2 (1.314E-2)	7.176E-2 (1.250E-1)	37.669	1.075
29	Petroleum Products	Log	Real	1.844E+2 (5.661E+1)		-1.181E-1 (3.607E-2)		3.253 (1.885)	4.505 (1.817)	4.694	1.860

Numbers in parentheses are standard errors.

TABLE E-3
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
COASTWISE RECEIPTS REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Real or Per Capita	Coefficients of Independent Variables			PI	POF	F-Statistic	Durbin Watson Statistic
				Constant	Term	Time	U.S. Shipments			
30	Rubber & Plastic Products	Linear	Per Capita	7.748E-2 (7.975E-3)		-3.962E-5 (4.091E-6)	8.415E-2 (1.389E-2)		46.959	2.279
31	Leather Products	Linear	Per Capita	-7.662E-7 (7.282E-5)			1.802E-2 (1.445E-2)		1.553	1.447
32	Stone, Clay, and Glass Products	Linear	Real	4.221E+6 (3.783E+6)		-2.160E+3 (1.937E+3)	2.755E-2 (1.668E-2)		1.709	2.102
33	Primary Metal Products	Log	Per Capita	1.220E+1 (1.619E+1)		-6.821E-3 (8.381E-3)	3.480E-1 (4.514E-1)		4.541	1.490
34	Fabricated Metal Products	Linear	Real	4.722E+6 (2.205E+5)		-2.413E+3 (1.126E+2)	1.076E-1 (4.262E-3)		430.069	2.205
35	Machinery, Except Electrical	Linear	Per Capita	3.703E-1 (6.399E-2)		-1.915E-4 (3.355E-5)		1.836E-3 (5.528E-4)	54.369	2.476
36	Electrical Machinery	Linear	Real	6.459E+6 (5.109E+6)		-3.350E+3 (2.657E+3)	3.205E-1 (7.266E-2)	1.685E-2 (1.763E-2)	24.965	1.487
37	Transportation Equipment	Linear	Real	3.229E+6 (7.201E+6)		-1.680E+3 (3.741E+3)		1.409E-2 (2.448E-2)	1.207	1.990
40	Waste, Scrap Materials	Log	Per Capita	3.096E+2 (1.057E+2)		-1.637E-1 (5.585E-2)	2.490E-1 (3.130E-1)	1.616E+1 (6.785)	11.460	1.799
	Other	Linear	Per Capita	4.001E-1 (1.446E-1)		-2.010E-4 (7.478E-5)	1.254E-2 (2.471E-2)		3.693	1.222

Numbers in parentheses are standard errors.

TABLE B-4
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
COASTWISE SHIPMENTS REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Coefficients of Independent Variables			F-Statistic	Durbin Watson Statistic
			Constant Term	Time	U.S. Receipts		
01	Farm Products	Linear	1.425E+5 (2.862E+4)		1.417E-2 (2.292E-2)	.383	2.691
08	Forest Products	Linear	-1.869E+4 (1.395E+4)	9.671 (7.114)		1.848	1.582
10	Metallic Ores	Linear	1.519E+5 (1.543E+5)	-7.664E+1 (7.868E+1)		.949	1.940
11 & 14	Non-Metallic Minerals & Coal	Linear	2.227E+7 (4.736E+6)	-1.125E+4 (2.414E+3)		21.718	.824
20 & 21	Food & Tobacco Products	Linear	3.893E+7 (5.231E+6)	-1.981E+4 (2.624E-3)	1.340E-1 (4.663E-2)	55.160	1.432
22 & 23	Textiles & Apparel Products	Linear	-1.630E+4 (4.185E+3)		2.061E-1 (3.703E-2)	30.986	.738
24 & 25	Lumber & Furniture Products	Log	-5.936E+1 (7.790)	3.249E-2 (3.971E-3)		66.936	1.295
26 & 27	Pulp, Paper, & Printed Matter	Log	-6.231E+1 (1.085E+1)	3.360E-2 (5.099E-3)	1.238E-1 (2.314E-1)	30.976	.900
28	Chemicals & Allied Products	Linear	-1.452E+7 (4.209E+6)	7.493E+3 (2.146E+3)		12.191	.702
29	Petroleum Products	Linear	4.448E+8 (1.335E+8)	-2.291E+5 (6.962E+4)	1.024E-1 (3.403E-2)	5.728	1.553
30	Rubber & Plastic Products	Linear	-1.294E+3 (5.926E+2)		1.007E-1 (1.458E-2)	47.757	.909

Numbers in parentheses are standard errors.

TABLE B-4
SAN FRANCISCO BAY AREA IN-DEPTH STUDY
FINAL PROJECTION EQUATIONS
COASTWISE SHIPMENTS REGRESSION STATISTICS

COMMODITY CODE	COMMODITY GROUP	Linear or Log	Coefficients of Independent Variables			F-Statistic	Durbin Watson Statistic
			Constant Term	Time	U. S. Receipts		
31	Leather Products	Linear	-1.246E+5 (1.201E+5)	6.249E+1 (6.144E+1)	1.215E-1 (3.432E-2)	9.645	1.343
32	Stone, Clay and Glass Products	Linear	2.651E+7 (2.973E+7)	-1.339E+4 (1.526E+4)	6.573E-2 (1.434E-1)	.794	.566
33	Primary Metal Products	Linear	1.358E+5 (6.970E+5)	8.529E+1 (3.527E+2)	7.496E-3 (1.155E-2)	.211	1.459
34	Fabricated Metal Products	Linear	5.494E+5 (2.168E+5)	2.819E+2 (1.108E+2)	2.411E-2 (4.069E-3)	36.628	1.674
35	Machinery, Except Electrical	Linear	8.478E+3 (1.361E+3)		2.479E-2 (7.736E-3)	10.270	1.880
36	Electrical Machinery	Log	-5.544E+1 (6.851)	2.895E-2 (3.730E-3)	5.185E-1 (2.353E-1)	51.862	1.504
37	Transportation Equipment	Log	1.345 (6.607E-1)		5.741E-1 (1.241E-1)	21.387	1.585
40	Waste, Scrap Materials	Linear	-7.457E+5 (1.999E+6)	3.841E+2 (1.016E+3)	2.344E-2 (9.979E-2)	7.511E-2	1.563
	Other	Linear	1.306E+7 (4.022E+6)	-6.704E+3 (2.064E+3)	1.737E-1 (2.002E-2)	57.288	1.657

Numbers in parentheses are standard errors.

APPENDIX C

Waterborne Commerce Commodity Classification
Code Conversion

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- NEW TO OLD -

NEW	OLD
0100	005
0100	050
0100	055
0100	060
0100	075
0100	090
0100	095
0100	098
0100	120
0100	130
0100	132
0100	140
0100	160
0100	161
0100	260
0100	280
0100	297
0101	300
0102	102
0103	100
0104	104
0105	101
0106	108
0107	103
0111	231
0112	232
0119	233
0119	234
0119	235
0119	236
0800	200
0800	408
0900	040
0900	049
0900	094
1000	610
1000	613
1000	614
1000	620
1000	640
1000	652
1000	660
1000	662
1000	670
1000	680
1000	682
1011	600
1051	617
1100	501
1100	502
1100	503

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- NEW TO OLD -

NEW	OLD
1300	511
1400	540
1400	549
1400	550
1400	551
1400	555
1400	852
1442	554
1491	553
1494	548
2000	013
2000	017
2000	018
2000	020
2000	033
2000	035
2000	037
2000	039
2000	043
2000	045
2000	047
2000	080
2000	107
2000	109
2000	110
2000	123
2000	125
2000	126
2000	127
2000	133
2000	135
2000	136
2000	137
2000	138
2000	150
2000	165
2000	167
2000	170
2000	185
2000	190
2000	195
2000	199
2000	240
2000	926
2011	010
2061	180
2062	183
2062	290
2100	285
2200	310
2200	320

WATERB NE COMMERCE
COMMODITY CLASSIFICATION CODE
- NEW TO OLD -

NEW OLD

2200 324

2200 325

2200 326

2200 328

2200 330

2200 331

2200 335

2200 340

2200 350

2200 380

2200 381

2200 390

2400 405

2400 411

2400 415

2400 416

2400 440

2411 400

2412 401

2421 413

2491 417

2491 421

2491 430

2600 450

2600 457

2600 460

2600 475

2611 441

2800 201

2800 210

2800 220

2800 250

2800 800

2800 801

2800 802

2800 803

2800 805

2800 806

2800 810

2800 825

2800 826

2800 827

2800 828

2800 829

2800 830

2800 837

2800 840

2800 844

2800 845

2800 846

2800 847

WATERBURY COMMERCE
COMMODITY CLASSIFICATION CODE
- NEW TO OLD -

NEW	OLD
2800	848
2800	860
2800	861
2800	862
2800	865
2800	899
2871	850
2871	851
2872	855
2873	853
2873	854
2879	849
2879	859
2900	505
2900	506
2900	507
2900	510
2900	512
2900	513
2900	514
2900	515
2900	518
2900	519
2900	522
2918	516
2918	552
2920	504
2920	517
2991	520
3000	203
3000	204
3000	205
3000	207
3100	065
3200	523
3200	525
3200	526
3200	530
3200	543
3200	547
3300	603
3300	604
3300	605
3300	608
3300	609
3300	615
3311	601
3312	556
3321	665
3321	690
3322	622

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- NEW TO OLD -

NEW	OLD
3322	624
3322	632
3323	642
3323	672
3324	618
3400	606
3400	607
3400	611
3400	612
3400	625
3400	630
3400	645
3400	650
3400	675
3500	710
3500	720
3500	722
3500	725
3500	730
3500	731
3500	740
3500	742
3500	745
3500	770
3500	773
3500	799
3600	700
3600	701
3700	783
3700	785
3700	786
3700	790
3700	793
3711	780
3711	781
3711	782
3711	787
3711	795
3711	796
4000	445
4000	930
4011	602
4100	900
4100	901
4100	920
4100	925
4100	940
4100	970
4100	980
4100	981
9999	999

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- OL TO NEW -

OLD	NEW
005	0100
010	2011
013	2000
017	2000
018	2000
020	2000
033	2000
035	2000
037	2000
039	2000
040	0900
043	2000
045	2000
047	2000
049	0900
050	0100
055	0100
060	0100
065	3100
075	0100
080	2000
090	0100
094	0900
095	0100
098	0100
100	0103
101	0105
102	0102
103	0107
104	0104
107	2000
108	0106
109	2000
110	2000
120	0100
123	2000
125	2000
126	2000
127	2000
130	0100
132	0100
133	2000
135	2000
136	2000
137	2000
138	2000
140	0100
150	2000
160	0100
161	0100
165	2000

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- OLD TO NEW -

OLD	NEW
167	2000
170	2000
180	2061
183	2062
185	2000
190	2000
195	2000
199	2000
200	0800
201	2800
203	3000
204	3000
205	3000
207	3000
210	2800
220	2800
231	0111
232	0112
233	0119
234	0119
235	0119
236	0119
240	2000
250	2800
260	0100
280	0100
285	2100
290	2062
297	0100
300	0101
310	2200
320	2200
324	2200
325	2200
326	2200
328	2200
330	2200
331	2200
335	2200
340	2200
350	2200
380	2200
381	2200
390	2200
400	2411
401	2412
405	2400
408	0800
411	2400
413	2421
415	2400

WATERB NE COMMERCE
COMMODITY CLASSIFICATION CODE
- OLD TO NEW -

OLD	NEW
416	2400
417	2491
421	2491
430	2491
440	2400
441	2611
445	4000
450	2600
457	2600
460	2600
475	2600
501	1100
502	1100
503	1100
504	2920
505	2900
506	2900
507	2900
510	2900
511	1300
512	2900
513	2900
514	2900
515	2900
516	2918
517	2920
518	2900
519	2900
520	2991
522	2900
523	3200
525	3200
526	3200
530	3200
540	1400
543	3200
547	3200
548	1494
549	1400
550	1400
551	1400
552	2918
553	1491
554	1442
555	1400
556	3312
600	1011
601	3311
602	4011
603	3300
604	3300

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- OLD TO NEW -

OLD	NEW
605	3300
606	3400
607	3400
608	3300
609	3300
610	1000
611	3400
612	3400
613	1000
614	1000
615	3300
617	1051
618	3324
620	1000
622	3322
624	3322
625	3400
630	3400
632	3322
640	1000
642	3323
645	3400
650	3400
652	1000
660	1000
662	1000
665	3321
670	1000
672	3323
675	3400
680	1000
682	1000
690	3321
700	3600
701	3600
710	3500
720	3500
722	3500
725	3500
730	3500
731	3500
740	3500
742	3500
745	3500
770	3500
773	3500
780	3711
781	3711
782	3711
783	3700
785	3700

WATERBORNE COMMERCE
COMMODITY CLASSIFICATION CODE
- OLD TO NEW -

OLD	NEW
786	3700
787	3711
790	3700
793	3700
795	3711
796	3711
799	3500
800	2800
801	2800
802	2800
803	2800
805	2800
806	2800
810	2800
825	2800
826	2800
827	2800
828	2800
829	2800
830	2800
837	2800
840	2800
844	2800
845	2800
846	2800
847	2800
848	2800
849	2879
850	2871
851	2871
852	1400
853	2873
854	2873
855	2872
859	2879
860	2800
861	2800
862	2800
865	2800
899	2800
900	4100
901	4100
920	4100
925	4100
926	2000
930	4000
940	4100
970	4100
980	4100
981	4100
999	9999

APPENDIX D

A METHODOLOGY FOR THE PROJECTION OF WATERBORNE COMMERCE MOVEMENTS
ON THE U.S. WEST COAST BY MAJOR PORT SYSTEMS

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August 16, 1974

A Report Prepared for
U.S. Department of the Army
South Pacific Division
Corps of Engineers
Economics Branch

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1. Introduction

The purpose of this paper is to outline a flexible methodology that may be used to generate projections of imports, exports, receipts and shipments disaggregated by commodities, by ports, and by methods and modes of transportation, in terms of both constant 1967 U.S. dollars and metric tons. Imports and receipts may be further disaggregated by origin and the exports and shipments by destination. There will, however, be no attempt to trace the ultimate destination of the imports and receipts or the ultimate origin of the exports and shipments.

Twenty-six commodity groups are distinguished. A list of these commodity groups is provided in Appendix 1. Six regional port systems are distinguished. They are:

- (1) Upper Pacific Northwest
- (2) Lower Pacific Northwest
- (3) Northern California
- (4) Southern California
- (5) Alaska
- (6) Hawaii.

Corresponding to these regional port systems are BEA (Bureau of Economic Analysis) areas identified as the hinterland of these port systems. A list of the regional port systems with their respective hinterland BEA areas is provided in Appendix 2.

Three separate methods of transportation are distinguished--air, land and water--and water transportation is further distinguished by four modes--containerized, general cargo, dry bulk, and liquid bulk.

The methodology is a flexible one in that it allows expansion and contraction as data availability and time permit and it has a multi-level modular structure so that future research can be built directly on the present methodology. For example, using the results from the present study, it is possible to obtain detailed projections of both the origin and the destination of imports, exports, receipts and shipments. Of course this will require detailed historical origin and destination data. The methodology is also partly determined by the availability of projections of the independent variables in 1980 and beyond from the other government or international agencies so as to achieve consistency and to avoid duplication of efforts.

The principal analytical tool used in this study is multiple regression analysis. Projections are obtained from equations whose coefficients are estimated by multiple regression analysis. However, in some instances, when the historical data are either unavailable or unreflective of future developments (e.g. oil from Alaska, trade with the People's Republic of China and U.S.S.R.), extraneous information is used.

2. Objectives

The objectives of this study are first, to review the past and present waterborne commerce movements, and second, to obtain projections of future waterborne commerce movements (1980, 1990, 2000, 2020) at each of the six regional port systems on the U.S. West Coast.

Specifically, projections will be obtained of the following:

(1) Imports, exports, receipts and shipments disaggregated by commodities and by port systems in constant 1967 U.S. dollars and in metric tons;

(2) Imports, exports, receipts and shipments disaggregated by commodities, by port systems, and by methods and modes of transportation in metric tons.

(3) Share of each port system in total waterborne commerce movements on the U.S. West Coast, by categories of imports, exports, receipts and shipments and by commodities.

(4) Imports and receipts by commodities, by port systems and by origin and exports and shipments by commodities, by port systems and by destination.

3. Outline of Study Plan

The study plan is structured in multiple levels, one building on the other. On the imports and receipts side, the first task is to estimate the constant dollar imports and receipts equations for each commodity group and each port system, and then using these equations, and extraneous projections of the values of the independent variables, principally from the OBERS studies, projections of total imports of each commodity group at each port system are generated. Second, using these constant dollar projections of imports and receipts, the corresponding total weight is derived, using an estimated weight conversion equation for each commodity group and each port system. Third, given the total weight, the allocation of the total to air, land and water transportation is determined through estimated allocation functions. Fourth, given total weight transported by water, it is further allocated to each of four modes--containerized, general cargo, dry bulk, liquid bulk--through estimated mode allocation functions. Fifth, going backwards, given total imports of the i th commodity group at the j th port, it is allocated among supplying countries through estimated import allocation functions. This determines the composition of imports by origin in constant dollars. Sixth, given the composition by origin in constant dollars, and assuming that the composition by origin in weight is the same, one can determine the total weight and weight disaggregated by methods and modes of transportation through the assumption of proportionality.

On the exports and shipments side, there are two alternative approaches. The first approach, which relies on rather stringent

assumptions, determines total constant dollars exports of the i th commodity at the j th port system through estimated export demand functions. Then, following the same procedure as for imports and receipts described above, one obtains the total weight and weight disaggregated by methods and modes of transportation. Given total exports, one then proceeds to allocate it to the various using countries. The second approach determines directly the exports of the i th commodity from the j th port to the k th country through estimated k th country export demand equations. Then, again, following the same procedure as for imports and receipts described above, one obtains the total weight and weight disaggregated by methods and modes of transportation.

4. Study Plan

4.1. Projection of Imports

The study of import demand when many commodities as well as their origins and destinations are distinguished is an extremely complex matter. In principle, one may adopt a very general approach, distinguishing all products (domestic as well as imported) by their characteristics individually (weight, origin, destination, etc.). Taking the technology and import prices as given, the consumers as a group are assumed to maximize their utility function subject to the technological constraints. The end result is a list of demands of commodities distinguished by their characteristics. This demand may be decomposed into two parts--consumption demand and intermediate demand. To implement this very general approach, assuming that data are available, requires a thorough examination of the domestic consumer preferences for domestic and foreign consumption commodities as well as of the domestic technological possibilities. This appears to be well beyond the scope of the present study.

Instead, we propose in this study to look only at the demand for imported products. Even then, we need some knowledge of the technology, but not quite the extensive knowledge necessary for the implementation of the general approach. Our limited approach may be rigorously justified on the basis of separability assumptions on consumers' preferences over domestic and imported products. In addition, we make the following assumptions. First, imports is primarily demand-determined, that is, the West Coast port systems can import as much as they desire at the prevailing price of imports. There are no supply constraints. Second, the hinterlands served by the port systems are assumed to be stationary, so that there is no drastic

reallocation of imports among port systems that is not attributable to changes in demand factors. Third, it is assumed that the existing port facilities, as well as the relative user costs of these facilities, are given and that no significant changes are foreseen. Fourth, there is no competitive reallocation of existing international trade routes. While we would also like to evaluate the relative competitiveness of the West Coast port systems, a methodology substantially different from the present study will be needed. Of course, the information generated in this study will be very useful for this purpose.

We specify that the imports of the i th commodity at the j th port is a function of the final consumption demand of the i th commodity in the hinterland region served by the j th port and the total intermediate demand of the i th commodity in the same region. Intermediate demand is defined as the total demand for the i th commodity as inputs to the industries in the j th region. In the context of this study, intermediate demand is derived from the regional input-output coefficients and the regional gross outputs. Inventory demand is not explicitly considered because it is assumed that a normal level of inventory, corresponding to any given levels of final consumption demand and intermediate demand (and relative prices), will be maintained. In addition, imports demand is also taken to be a function of the import and domestic prices of the i th commodity in the j th region, the general domestic price level in the j th region, population in the j th region, and time. We therefore have the following equations:

$$(4.3.1) \quad M^{ij} = \alpha_0^{ij} + \beta^{ij} \frac{p_m^{ij}}{p_c^j} + \gamma^{ij} \frac{p_c^{ij}}{p_c^j} + \delta^{ij} \frac{C^{ij}}{p_c^j} + \eta^{ij} Z^{ij} + \xi^{ij} N^j + \rho^{ij} t$$

or

$$(4.3.2) \quad \frac{M^{ij}}{N^j} = \alpha_0^{ij} + \beta^{ij} \frac{p_m^{ij}}{p_c^j} + \gamma^{ij} \frac{p_c^{ij}}{p_c^j} + \delta^{ij} \frac{(C^{ij}/N^j)}{p_c^j} + \eta^{ij} \frac{Z^{ij}}{N^j} + \rho^{ij} t,$$

where M^{ij} is imports of the i th commodity at the j th port in constant 1967 U.S. dollars; p_m^{ij} is the import price index of the i th commodity at the j th port with base year in 1967; p_c^j is the cost-of-living index in the j th region with base year in 1967; p_c^{ij} is the domestic price of the i th commodity at the j th region; C^{ij} is the total dollar final consumption of the i th commodity in the j th region; and N^j is the population in the j th region.

Equations (4.3.1) and (4.3.2) represent the total and per capita versions of the import demand functions. A priori, there is little to choose between them, and we shall make a choice on the basis of relative goodness of fit. We note that both versions satisfy the assumption of zero degree homogeneity in prices; in other words, there is an absence of money illusion. The expected signs of the coefficients are: $\beta^{ij} \leq 0$; $\gamma^{ij} \geq 0$; $\delta^{ij} \geq 0$, $\eta^{ij} \geq 0$, $\xi^{ij} \geq 0$.

Both equations (4.3.1) and (4.3.2) may be simplified to accommodate the availability of data. If data on final consumption demands are unavailable on the commodity level, one may substitute C^{ij} by C^j , the total dollar consumption in the j th region, or even failing that, by Y^j , the total dollar personal disposable income of the j th region. (Disposable income may also be unavailable as a time series, in which case personal income will have to be used

instead. However, if effective tax rates do not change substantially, personal income will do just as well.) The computations of the Z^{ij} 's are detailed in Appendix 6. If Z^{ij} 's are unavailable, it may be substituted by I^j , the constant dollar gross industrial production of the j th region. It is also possible, to further simplify data requirements, to assume that p_m^{ij} is independent of j , that is, the import price of the i th commodity is independent of the destination; and $p_c^{ij} = p_c^i$, that is, the domestic price of the i th commodity is the same in all regions; and $p_c^j = p_c$, that is, the cost-of-living index is the same in all regions. Whether any or all of the simplifying assumptions will be adopted depends on data and time availability.

So far we have proceeded as if all the imports at the j th port will be used completely in the j th region, either as final consumption, or as intermediate inputs. We have not taken into account the possibility that part of the imports may be ultimately destined to a point beyond the j th region. To take this into account will require separate import functions for each port-ultimate destination pair. For example, we need to estimate an import demand function for Kansas of the i th commodity imported at San Francisco. Even if detailed origin and destination data are available on a time series basis, such a task is extremely resource-intensive and time-consuming. A short-cut approach is the following--we define imports of the i th commodity at the j th port as:

$$(4.3.3) \quad M^{ij} = \alpha_0^{ij} + \beta^{ij} \left(\frac{\overline{p_m^{ij}}}{p_c^j} \right) + \gamma^{ij} \left(\frac{\overline{p_c^{ij}}}{p_c^j} \right) + \delta^{ij} \left(\frac{\overline{C^{ij}}}{p_c^j} \right) + \eta^{ij} \overline{Z^{ij}} + \xi^{ij} \overline{N^j} + \rho^{ij} t,$$

where $\overline{\left(\frac{p_m^{ij}}{p_c^j}\right)}$ is a weighted average of the import prices deflated by the cost-of-living index over the ultimate destinations of the i th commodity imported through the j th port. In other words:

$$\overline{\left(\frac{p_m^{ij}}{p_c^j}\right)} \equiv \sum_k w_{k0}^{ij} \left(\frac{p_m^{ij}}{p_c^j}\right),$$

where w_{k0}^{ij} is the base year value share of total imports of the i th commodity through the j th port that is transshipped to the k th region; similarly, for all the other variables. For example, $\overline{(C^{ij}/p_c^j)}$ is a weighted average of the consumption of the i th commodity at the k th region, and $\overline{N^j}$ is a weighted average of the populations of all the regions, all with w_{k0}^{ij} as weights. All the remarks about simplifications of equation (4.3.1) apply here. At the simplest level, we have:

$$(4.3.4) \quad M^{ij} = \alpha_0^{ij} + \beta^{ij} \left(\frac{p_m^i}{p_c}\right) + \gamma^{ij} \left(\frac{p_c^i}{p_c}\right) + \delta^{ij} \left(\sum_k w_{k0}^{ij} \bar{Y}^k\right) + \eta^{ij} \left(\sum_k w_{k0}^{ij} Z^{ik}\right) \\ + \xi^{ij} \left(\sum_k w_{k0}^{ij} N^k\right) + \rho^{ij} t,$$

where $\bar{Y}^k$ is real personal income in the k th region. Here it is seen that the simplifying assumptions on the prices play a most important role. $(\sum_k w_{k0}^{ij} Z^{ik})$ may further be substituted by $(\sum_k w_{k0}^{ij} I^k)$. We note that a set of equation (4.3.3) may be obtained from equations (4.3.1), one for each ultimate using region k , if it is assumed that the coefficients for each k th region are proportional to one another and that the constant of proportionality is their relative value shares in the base year.

After the equations are estimated, it is necessary to obtain projections for 1980 and beyond. For such projections, we use as inputs the OBERS projections of personal income, industrial outputs, and population for 1980. Projections of intermediate demand may be derived from the OBERS projections of industrial output, given a table of input-output coefficients. The prices also need to be independently projected. It is proposed that the projections be made on the basis of time trend variables, that is, we estimate equations of the type:

$$p_m^{ij} = a_{m0}^{ij} + a_{m1}^{ij}t + \frac{1}{2} a_{m2}^{ij}t^2,$$

$$p_c^j = b_{c0}^j + b_{c1}^j t + \frac{1}{2} b_{c2}^j t^2,$$

$$p_c^{ij} = c_{c0}^{ij} + c_{c1}^{ij}t + \frac{1}{2} c_{c2}^{ij}t^2.$$

Because the prices are projected, in computing the standard error of a forecast, it is necessary to take into account the variance of the projected prices in addition to the variances and covariances of the coefficients. The way this should be done is sketched in Section 4.5 in connection with the weight conversion equation.

4.2. Projection of Receipts

Total receipts of the i th commodity at the j th port may be treated in the same manner as total imports of the i th commodity. The difference is in the substitution of the import price index by the receipts price index, which should be a base year value share weighted average of the prices of the i th commodity in each of the supplying regions distinguished. In addition to the six regions served by the six West Coast port systems, an additional region, rest-of-the-U.S., is distinguished. Projection procedure is similar to that in Section 4.1.

Allocation of the receipts at the j th port among its supplying regions is done in the same way as the allocation of imports as described in Section 4.8.

4.3. Projection of Exports

The methodology for the projection of exports is different from that of projection of imports because under the assumptions of a demand-determined system, one cannot explain the quantity of exports primarily on the basis of developments in the U.S. In fact, it will be the developments in the using countries that will be relevant. The analysis here is slightly more complex than that of imports because there is no reason to suppose that developments in the different using countries are in any way uniform. Thus, one must take into account the particular circumstances of each important using country.

Be that as it may, we shall start with a model with strong simplifying assumptions and relatively austere data requirements; and move progressively to more realistic and necessarily more complex models with much more stringent data requirements.

The first specification that we consider is the following:

$$(4.3.1) \quad X^{ij} = \alpha_0^{ij} + \beta^{ij} p_x^{ij} + \gamma^{ij} p_w^i + \delta^{ij} M_w^i + \eta^{ij} t$$

where X^{ij} = exports of the i th commodity from the j th port;

p_x^{ij} = export price index of the i th commodity from the j th port;

p_w^i = world price index of the i th commodity;

M_w^i = total world imports of the i th commodity;

t = time trend.

The expected signs of the coefficients are:

$$\beta^{ij} \leq 0;$$

$$\gamma^{ij} \geq 0;$$

$$\delta^{ij} \geq 0.$$

One may simplify equation (4.3.1) by dropping the j superscripts on the coefficients β^{ij} , γ^{ij} , δ^{ij} , η^{ij} . This amounts to saying that the demand for exports is independent of the port system from which it is shipped.

A second specification that we consider is the following:

$$(4.3.2) \quad X^{ij} = \alpha_0^{ij} + \beta^{ij} p_x^{ij} + \gamma^{ij} p_w^i + \delta^{ij} Z^{ij} + \eta^{ij} t$$

where Z^i is a weighted average of the imports of the i th commodity of all the using countries, namely,

$$Z^{ij} = \sum_k w_{k0}^{ij} M_k^i.$$

w_{k0}^{ij} is the value share in the base year of the exports of the i th commodity at the j th port to the k th country in the total exports of the i th commodity at the j th port. Z^{ij} reflects external demand conditions for the j th port better than M_w^i , because an increase in the M_w^i arising from an increase of the imports of a country which is not a traditional using country may have no impact on U.S. exports from the j th port. As before, the j superscripts on the coefficients may be dropped if simplification is desirable.

A third specification consists of substituting p_w^i by a weighted average of the import price indexes of the using countries. Thus:

$$(4.3.3) \quad X^{ij} = \alpha_0^{ij} + \beta^{ij} p_x^{ij} + \gamma^{ij} p_m^{ij} + \delta^{ij} Z^{ij} + \eta^{ij} t$$

where $\bar{p}_m^{ij} \equiv \sum_k w_{k0}^{ij} p_{k,m}^i$.

A fourth specification consists of separate allocation functions for each major using country:

$$(4.3.4) \quad X_k^{ij} = \alpha_{k0}^{ij} + \beta_k^{ij} p_x^{ij} + \gamma_k^{ij} p_{k,m}^i + \delta_k^{ij} M_k^i + \eta_k^{ij} t.$$

Equation (4.3.3) may be regarded as a specialization of the system of equations (4.3.4) if all the coefficients in different equations are proportional with the constants of proportionality equal to the base year relative shares. We note here again that all supply factors act through the price variables. Thus one is justified in not introducing supply variables such as surplus of domestic production over consumption explicitly. Also, we use foreign imports as the independent variable rather than other foreign economic activity variables so as to minimize the need for projections of foreign economic activities. Finally, since supply factors are not explicitly considered, the question of the hinterland which arises in the context of import demands, does not arise here.

In order to obtain projections of total exports and the allocation of total exports among using countries, it is necessary to use as inputs projections of the export price, the world price, total world imports, import price and total import quantity of each individual major using country for each commodity. It is proposed that these inputs be obtained in two ways. First, they can be generated through mechanical trendline projections of the type

$$p_x^{ij} = a_0^{ij} + a_1^{ij}t + \frac{1}{2} a_2^{ij}t^2.$$

And second, insofar as possible, these projections may be substituted by projections made by the International Bank for Reconstruction and Development, the International Monetary Fund, and the United Nations.

Standard errors of the forecast may be derived in a way similar to that of the weight forecast described in Section 4.5.

4.4. Projection of Shipments

Intra-West Coast shipments need not be independently projected. They may just be obtained from the projections of the intra-West Coast receipts. Shipments to the rest of the country may be projected by the use of an equation similar to equation (4.3.4), where p_x^{ij} may be taken to be the local price of the i th commodity at the j th port and $p_{k,m}^i$ may be taken to be the local price of the i th commodity at the k th region. It is possible to distinguish more than one non-West Coast destination. However, it may be desirable in this initial study to limit consideration to only a single rest-of-the-U.S. region.

4.5. Weight Conversion

Having obtained the projected total quantities of imports, exports, receipts and shipments of each commodity group in constant 1967 U.S. dollars for each of the six port systems, it is necessary to convert these quantities into weight-equivalents. We propose to make the quantity-weight conversion on the basis of empirically estimated relationships. For each commodity group for each port system, it is postulated that the total weight in metric tons of the i th commodity group in the j th port is related to the constant-dollar quantity and time by a quadratic equation, namely:

$$W_{ijt}^z = W_{ij0} + \alpha_{ij1}Z_{ijt} + \alpha_{ijt}t + \frac{1}{2}\beta_{ij11}Z_{ijt}^2 + \beta_{ij1t}Z_{ijt} \cdot t \\ + \frac{1}{2}\beta_{ijtt}t^2$$

where Z_{ijt} is the constant 1967 U.S. dollars quantity of imports, exports, receipts or shipments respectively, and t is an index of calendar time taking the value zero in 1967. The introduction of the time trends allows for the changes in design, material, packaging, etc. of the commodity group in question as well as possible intra-commodity group changes in composition which leaves the total constant dollar quantity unchanged. If there is no change in the weight-conversion factor over time, as perhaps one may expect for certain bulk commodities such as wheat, then all the coefficients with the exception of α_{ij1} are likely to be statistically insignificantly different from zero.

The weight conversion equation is estimated with historical data, for each commodity group and for each port system and for each of the categories of imports, exports, shipments and receipts. It is necessary to estimate separate weight conversion equations for the same commodity for each port system and category of imports, exports, receipts and shipments because of possible variation of weight characteristics due to differences in the commodity composition of the different categories. For instance, the composition of metallic ores imported will be quite different from the composition of metallic ores exported. Consequently, even if imports and exports in constant 1967 U.S. dollars are equal to each other, their weight may be quite different. It is possible that many of the estimated coefficients may turn out to be statistically insignificant, and one may drop the independent variables corresponding to these estimated coefficients without much loss. We shall call a specification any specialization of the weight conversion equation in which one or more of the independent variables have been dropped. Of course, the original weight conversion equation itself is also a specification. It is necessary to choose a final specification for the purposes of projection. One possible strategy of such a choice is to apply the following criteria:

(1) Other things being equal, an increase in the constant dollar quantity should lead to an increase in weight or at least not a decrease in weight. Thus, the partial derivative of W_{ijt}^Z with respect to Z_{ijt} should be nonnegative, that is:

$$\frac{\partial W_{ijt}^2}{\partial Z_{ijt}} = \alpha_{ij1} + \beta_{ij11}Z_{ijt} + \beta_{ij1t}t \geq 0.$$

In 1967, the base period, $t = 0$, so in order that $\frac{\partial W_{ijt}^z}{\partial Z_{ijt}} \geq 0$ for all nonnegative values of Z_{ijt} , one must have:

$$\alpha_{ij1} \geq 0; \quad \beta_{ij11} \geq 0.$$

In addition, one must check that for the time period under consideration:

$$\alpha_{ij1} + \beta_{ij1t}t \geq 0, \quad \forall t.$$

(2) Amongst all specifications satisfying criterion (1), the specification with the smallest standard error of the estimate, adjusted for degrees of freedom, is chosen as the final specification. The standard error of the estimate, adjusted for degrees of freedom, s , is defined by:

$$s^2 = \frac{e'e}{T-K}$$

where T is the total number of observations used in estimating the equation and K is the total number of independent variables (including the constant term) used in estimating the equation.

To implement the specification search strategy, one may assume, with obvious justification, that Z_{ijt} always belongs in the equation. Moreover, it is assumed that the term linear in t has to have an effect if the term quadratic in t is to have an effect. Thus, one is led to the following procedure:

(1) Estimate the equations:

$$(4.5.1) \quad W_{ijt}^Z = \alpha_{ij1} Z_{ijt}$$

$$(4.5.2) \quad W_{ijt}^Z = W_{ij0} + \alpha_{ij1} Z_{ijt}$$

$$(4.5.3) \quad W_{ijt}^Z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t.$$

(2) Apply criteria (1) and (2) above. If either equation (4.5.1) or equation (4.5.2) is the best specification, then the search terminates. We choose it to be the final specification. It is most unlikely that all three specifications will not satisfy criterion (1).

(3) If equation (4.5.3) is the best specification, then the search continues by a stepwise technique. The following equations are estimated:

$$(4.5.4) \quad W_{ijt}^Z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \frac{1}{2} \beta_{ij11} Z_{ijt}^2$$

$$(4.5.5) \quad W_{ijt}^Z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \beta_{ij1t} Z_{ijt} t$$

$$(4.5.6) \quad W_{ijt}^Z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \frac{1}{2} \beta_{ijtt} t^2.$$

(4) Apply criteria (1) and (2) above. If equation (4.5.3) turns out to be the best specification, the search terminates. If any of the three equations listed under (3) above is the best, the search continues by adding one more independent variable to it at a time.

(5) Suppose equation (4.5.4) is the best specification; the following two additional equations are estimated:

$$(4.5.7) \quad W_{ijt}^z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \frac{1}{2} \beta_{ij11} Z_{ijt}^2 + \beta_{ij1t} Z_{ijt} t$$

$$(4.5.8) \quad W_{ijt}^z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \frac{1}{2} \beta_{ij11} Z_{ijt}^2 + \frac{1}{2} \beta_{ijtt} t^2.$$

(6) Apply criteria (1) and (2) above. If equation (4.5.4) is still the best specification, the search terminates. If either equation (4.5.7) or equation (4.5.8) is the best specification, the search continues by adding the remaining independent variable.

(7) Suppose equation (4.5.7) is the best specification; the following additional equation is estimated:

$$(4.5.9) \quad W_{ijt}^z = W_{ij0} + \alpha_{ij1} Z_{ijt} + \alpha_{ijt} t + \frac{1}{2} \beta_{ij11} Z_{ijt}^2 + \beta_{ij1t} Z_{ijt} t \\ + \frac{1}{2} \beta_{ijtt} t^2.$$

This equation is precisely the original weight conversion equation.

(8) Apply criteria (1) and (2) above and search terminates. One may similarly work out the procedure for other contingencies.

Having obtained the final specification one is then in a position to predict the weight corresponding to a given constant dollar

quantity of imports, exports, receipts and shipments of any commodity group for any port system at any given time. Let X_{ij}^0 be the row vector of given independent variables:

$$X_{ij}^0 = [1 \ z_{ijt} \ t \ \frac{z_{ijt}^2}{2} \ z_{ijt}t \ \frac{t^2}{2}].$$

Let $\hat{\beta}$ be the vector of estimated coefficients:

$$\hat{\beta} = \begin{bmatrix} \hat{w}_{ij0} \\ \hat{\alpha}_{ij1} \\ \hat{\alpha}_{ijt} \\ \hat{\beta}_{ij11} \\ \hat{\beta}_{ij1t} \\ \hat{\beta}_{ijtt} \end{bmatrix}.$$

Then the predicted weight, given the independent variables, is given by

$$\hat{w}_{ij} = X_{ij}^0 \hat{\beta}.$$

The variance forecast error is given by

$$\begin{aligned} e_0 &= w_{ij}^0 - \hat{w}_{ij}^0 \\ &= w_{ij}^0 - X_{ij}^0 \hat{\beta} \end{aligned}$$

where w_{ij}^0 is the true weight. The true weight deviates from our weight

conversion equation by an unknown error, ϵ_{ij}^0 . However, we do have an estimate of σ^2 , the variance of the unknown error. We may write:

$$e_0 = X_{ij}^0 \beta + \epsilon_{ij}^0 - X_{ij}^0 \hat{\beta}.$$

The variance of the forecast error conditional on X_{ij}^0 is given by:

$$v(e_0) = \sigma^2 + X_{ij}^0 v(\hat{\beta}) X_{ij}^0,$$

where $v(\hat{\beta})$ is the variance-covariance matrix of the estimator of $\hat{\beta}$, since ϵ_{ij}^0 and $\hat{\beta}$ are distributed independently under our assumptions. A standard error of the forecast, conditional on X_{ij}^0 , may then be computed as

$$s(e_0) = \sqrt{s^2 + X_{ij}^0 \hat{v}(\hat{\beta}) X_{ij}^0},$$

where s^2 and $\hat{v}(\hat{\beta})$ are unbiased estimators of σ^2 and $v(\hat{\beta})$ respectively.

In the event that the X_{ij}^0 itself is also subject to error, as may be the case in our application, that the Z_{ij}^0 's are the predicted rather than the actual values, it may be necessary to take this into account in the calculation of the standard error of the forecast. To do this, we make use of the relationship that the variance of any continuously differentiable function of an estimator $\hat{\gamma}$ of γ is given by:

$$v(f(\hat{\gamma})) \cong \frac{\partial f}{\partial \hat{\gamma}} v(\hat{\gamma}) \frac{\partial f}{\partial \hat{\gamma}}.$$

We note that the forecast error is now given by:

$$\begin{aligned} e_0 &= w_{ij}^0 - \hat{w}_{ij} \\ &= \bar{x}_{ij}^0 \beta + \epsilon_{ij}^0 - x_{ij}^0 \hat{\beta} \end{aligned}$$

where $\bar{x}_{ij}^0$ is the true value of x_{ij}^0 . Applying our formulae to the calculation of the variance of the forecast error, we have, assuming independence between the errors of the x_{ij}^0 forecast and the errors of the weight conversion equation:

$$\begin{aligned} v(e_0) &\approx [1 - x_{ij}^0 - \hat{\beta}'] \begin{bmatrix} \sigma^2 & 0 & 0 \\ 0 & v(\hat{\beta}) & 0 \\ 0 & 0 & v(x_{ij}^0) \end{bmatrix} \begin{bmatrix} 1 \\ -x_{ij}^0 \\ -\hat{\beta} \end{bmatrix} \\ &= \sigma^2 + x_{ij}^0 v(\hat{\beta}) x_{ij}^{0'} + \hat{\beta}' v(x_{ij}^0) \hat{\beta}. \end{aligned}$$

A consistent estimator of the variance of the forecast is therefore given by:

$$\hat{v}(e_0) = s^2 + x_{ij}^0 \hat{v}(\hat{\beta}) x_{ij}^{0'} + \hat{\beta}' \hat{v}(x_{ij}^0) \hat{\beta}$$

where $\hat{v}(x_{ij}^0)$ is an estimator of the variance of the forecast error of x_{ij}^0 . The standard error of the forecast of w_{ij}^0 is given by:

$$s(e_0) = \sqrt{s^2 + x_{ij}^0 \hat{v}(\hat{\beta}) x_{ij}^{0'} + \hat{\beta}' \hat{v}(x_{ij}^0) \hat{\beta}}.$$

In this particular case of projecting the weight given the constant dollar quantity, we have:

$$\begin{aligned}\hat{w}_{ij}^0 &= \hat{w}_{ij0} + \hat{\alpha}_{ij1} z_{ij}^0 + \hat{\alpha}_{ijt} t + \frac{1}{2} \hat{\beta}_{ij11} z_{ij}^{0^2} + \hat{\beta}_{ij1t} z_{ij}^0 t \\ &\quad + \frac{1}{2} \hat{\beta}_{ijtt} t^2.\end{aligned}$$

Let $\hat{\beta}$ be the vector of estimated coefficients, as before. Of the independent variables in the weight conversion equations, only z_{ij}^0 and functions of z_{ij}^0 are projected with error. Therefore, the forecast error is given by:

$$\begin{aligned}e_0 &= w_{ij}^0 - \hat{w}_{ij}^0 \\ &= w_{ij}^0 + \alpha_{ij1} \bar{z}_{ij}^0 + \alpha_{ijt} t + \frac{1}{2} \beta_{ij11} \bar{z}_{ij}^{0^2} + \beta_{ij1t} \bar{z}_{ij}^0 t \\ &\quad + \frac{\beta_{ijtt} t^2}{2} + \epsilon_{ij}^0 - (\hat{w}_{ij0} + \hat{\alpha}_{ij1} z_{ij}^0 + \hat{\alpha}_{ijt} t \\ &\quad + \frac{1}{2} \hat{\beta}_{ij11} z_{ij}^{0^2} + \hat{\beta}_{ij1t} z_{ij}^0 t + \frac{\hat{\beta}_{ijtt} t^2}{2})\end{aligned}$$

$$\frac{\partial e_0}{\partial \hat{\gamma}} = \begin{bmatrix} -1 \\ -z_{ij}^0 \\ -t \\ -\frac{1}{2} z_{ij}^{0^2} \\ -z_{ij}^0 t \\ -\frac{1}{2} t^2 \\ -(\hat{\alpha}_{ij1} + \hat{\beta}_{ij11} z_{ij}^0 + \hat{\beta}_{ij1t} t) \end{bmatrix}$$

$$\therefore, s(e_0) \approx \sqrt{s^2 + x_{ij}^0{}' \hat{v}(\hat{\beta}) x_{ij}^0{}' + (\hat{\alpha}_{ij1} + \hat{\beta}_{ij11} z_{ij}^0 + \hat{\beta}_{ij1t} t)^2 \hat{v}(z_{ij}^0)}.$$

This can be readily computed given a knowledge of s^2 , x_{ij}^0 , $\hat{v}(\hat{\beta})$, $\hat{\beta}$ and $\hat{v}(z_{ij}^0)$.

It should be pointed out that implicit in our weight conversion procedure is the assumption that the weight conversion factor is independent of intragroup commodity composition by product, by the country of origin, or by the country of destination, given any one particular commodity group, port system, and whether it is imports, exports, receipts or shipments. And to the extent that it is not independent it is assumed that whatever the effects of changing intragroup commodity composition, they are adequately captured by the presence of trend terms.

4.6. Air-Land-Water Allocation

Given the total weight of imports, exports, receipts or shipments of a given commodity group at a given port system, it is necessary to allocate these by the method of transportation--namely, by air, land (rails and trucks) and water (oceans, rivers and lakes). Most of the commodities are transported by either air or water. Land is included for the sake of completeness because of its relative importance for the trade between the U.S. and Canada, and between the U.S. and Mexico and in certain commodities such as crude oil and natural gas (through pipelines).

To allocate the total weight by the method of transportation we introduce commodity-group specific transportation allocation functions.

The transportation allocation functions of the i th commodity group at the j th port (either as origin or as destination) are given by:

$$(4.6.1) \quad X_1^{ij} = \alpha_{ij1} + \beta_{ij1} \frac{p_1^{ij}}{p_{ij}} + \gamma_{ij1} \frac{p_2^{ij}}{p_3} + \delta_{ij1} \bar{X}^{ij} + \epsilon_{ij1} t$$

$$(4.6.2) \quad X_2^{ij} = \alpha_{ij2} + \beta_{ij2} \frac{p_1^{ij}}{p_{ij}} + \gamma_{ij2} \frac{p_2^{ij}}{p_3} + \delta_{ij2} \bar{X}^{ij} + \epsilon_{ij2} t$$

$$(4.6.3) \quad X_3^{ij} = \alpha_{ij3} + \beta_{ij3} \frac{p_1^{ij}}{p_{ij}} + \gamma_{ij3} \frac{p_2^{ij}}{p_3} + \delta_{ij3} \bar{X}^{ij} + \epsilon_{ij3} t$$

where X_1^{ij} , X_2^{ij} and X_3^{ij} are the weights in metric tons of imports, exports, receipts or shipments transported by air, land and water,

respectively. $\bar{X}^{ij}$ is the total weight of imports, exports, receipts or shipments of the i th commodity at the j th port; p_1^{ij} , p_2^{ij} and p_3^{ij} are the indexes of costs per metric ton-mile of transportation of the i th commodity at the j th port by air, land and sea with base year 1967 respectively; and t is a time trend variable with the value zero in 1967. Conceptually, one should have measured X_1^{ij} , X_2^{ij} , X_3^{ij} and $\bar{X}^{ij}$ in terms of metric ton-miles rather than metric tons. However, to take distances into account explicitly will require much more detailed analysis and data. It is therefore assumed that the average distance shipped per unit weight of the i th commodity by any method (assuming that the method is used at all) is on the average equal across all three methods.

We note that the transportation allocation functions are homogeneous of degree zero in the costs of transportation, that is, if the costs per metric ton-mile of all methods of transportation are increased in the same proportion, the relative allocation of transportation, given the total weight, remains unchanged. Moreover, because the individual allocations must add up to the total weight, the following relationships must hold amongst the coefficients:

$$\alpha_{ij1} + \alpha_{ij2} + \alpha_{ij3} = 0$$

$$\beta_{ij1} + \beta_{ij2} + \beta_{ij3} = 0$$

$$\gamma_{ij1} + \gamma_{ij2} + \gamma_{ij3} = 0$$

$$\delta_{ij1} + \delta_{ij2} + \delta_{ij3} = 1$$

$$\epsilon_{ij1} + \epsilon_{ij2} + \epsilon_{ij3} = 0.$$

Thus, given the coefficients of any two equations, the coefficients of the third equation may be derived from these restrictions. In fact, because of this adding up property, only two of the three equations are stochastically independent, and we need only estimate two of these equations. We propose to estimate equations (4.6.1) and (4.6.3), because land transportation is relatively unimportant and the emphasis of our study is on water transportation. The expected signs of the coefficients are:

$$\beta_{ij1} \leq 0;$$

$$\gamma_{ij2} \geq 0;$$

$$\delta_{ij1} \geq 0;$$

$$\beta_{ij3} \geq 0;$$

$$\gamma_{ij3} \geq 0;$$

$$\delta_{ij3} \geq 0.$$

In the event that one of the methods of transportation has never been utilized for the i th commodity group at the j th port historically, one can just drop that particular independent variable and that equation. The result is that only one equation will be estimated and with one fewer dependent variable. For example, if land transportation is never used, the equation to be estimated becomes

$$(4.6.4) \quad X_3^{ij} = \alpha_{ij3} + \beta_{ij3} \frac{p_1^{ij}}{p_3^{ij}} + \delta_{ij3} \bar{X}^{ij} + \epsilon_{ij3} t.$$

The coefficients of equation (4.6.1) may then be derived as follows:

$$\alpha_{ij1} + \alpha_{ij3} = 0;$$

$$\beta_{ij1} + \beta_{ij3} = 0;$$

$$\gamma_{ij1} = 0;$$

$$\delta_{ij1} + \delta_{ij3} = 1;$$

$$\epsilon_{ij1} + \epsilon_{ij3} = 0.$$

We note that the transportation allocation functions imply that it is not the case that in general only one method of transportation which has the lowest cost per metric ton-mile is chosen, as one may expect on the basis of transportation cost minimization considerations. Instead, very often more than one method are used concurrently. There are several reasons for this. Different products in the same commodity group may have very different transportation characteristics. E.g. both flower and wheat belong to the commodity group "Farm Products." However, because of perishability, flowers may only be shipped by air and not by sea. Thus, if flowers is included as a part of the total weight of the i th commodity group, X_1^{ij} will have to be positive as well. Second, there may be effects of differential location of the origins and destinations. For example, if Japan is a substantial importer of the i th commodity group from the U.S., clearly, one will be unable to use land transportation exclusively. Third, even if the commodity group is homogeneous, it may still not be possible to choose the methods of transportation arbitrarily because of the problems of time-phasing of production and delivery schedules. Thus, often the bulk of a shipment may come by water, and the remainder may come by air. Corner solutions

are therefore not as frequent as they may be expected to be. Because of all these differences, it is also assumed that the transportation allocation functions of the i th commodity at the j th port are different for imports, exports, receipts and shipments.

If historically only one method of transportation has been used, there is no need to estimate any equation. The total weight coefficient for that method will be identically one; all the other coefficients of the allocation functions will be zero.

If there are limitations of data availability and/or time, several simplifications are possible. First, one can drop the distinctions between imports, exports, receipts and shipments, and pool all the data. Second, one can drop the distinctions between ports and pool all the data for all the port systems. Third, if commodity group-specific costs per metric ton-mile by method of transportation are not available, but the general costs per metric ton-mile by method of transportation are available, one can approximate the commodity group-specific costs by the equations:

$$\frac{p_1^{ij}}{p_3^{ij}} = a_1 + b_1 \frac{p_1^j}{p_3^j} + c_1 q^{ij};$$

$$\frac{p_2^{ij}}{p_3^{ij}} = a_2 + b_2 \frac{p_2^j}{p_3^j} + c_2 q^{ij},$$

where p_k^j is the cost per metric ton-mile at the j th port for the k th method of transportation, and q^{ij} is the price index of the i th commodity group at the j th port. Substitution of these equations into

equations (4.6.1) through (4.6.3) gives:

$$(4.6.5) \quad x_1^{ij} = \alpha_{ij1} + \beta_{ij1} \frac{p_1^j}{p_3^j} + \gamma_{ij1} \frac{p_2^j}{p_3^j} + \delta_{ij1} \bar{x}^{ij} + \epsilon_{ij1} t + \eta_{ij1} q^{ij}.$$

$$(4.6.6) \quad x_2^{ij} = \alpha_{ij2} + \beta_{ij2} \frac{p_1^j}{p_3^j} + \gamma_{ij2} \frac{p_2^j}{p_3^j} + \delta_{ij2} \bar{x}^{ij} + \epsilon_{ij2} t + \eta_{kj2} q^{ij}.$$

$$(4.6.7) \quad x_3^{ij} = \alpha_{ij3} + \beta_{ij3} \frac{p_1^j}{p_3^j} + \gamma_{ij3} \frac{p_2^j}{p_3^j} + \delta_{ij3} \bar{x}^{ij} + \epsilon_{ij3} t + \eta_{ij3} q^{ij}.$$

As before, equations (4.6.5) and (4.6.7) may be estimated, and the coefficients of the equation (4.6.6) may be derived from the adding-up condition. As mentioned earlier, if data are unavailable, one can drop the j superscript from the variables p_1^j , p_2^j , p_3^j and q^{ij} . Fourth, one can drop the price variables completely from the empirical analysis. The advantage of the resulting system of allocation functions is that it requires no price data, which are generally difficult to come by. The disadvantage is, of course, that it fails to capture the possible substitution effects due to price changes.

Before closing, a word needs to be said about projection. To project x_k^{ij} , $k=1,2,3$; we need projections of $\bar{x}^{ij}$, which is available either from the procedure outlined in Section 4.5 or from some extraneous source. We also need projections of the relative costs of transportation. These projections may be generated in at least three ways. First, there is straightforward trend line projection, that is,

$$\frac{p_1^{ij}}{p_3^{ij}} = d_1 + e_1 t + \frac{1}{2} f_1 t^2$$

$$\frac{p_2^{ij}}{p_3^{ij}} = d_2 + e_2 t + \frac{1}{2} f_2 t^2.$$

And if projections of q^{ij} are needed, they can also be generated as:

$$q^{ij} = d_3 + e_3 t + \frac{1}{2} f_3 t^2.$$

Second, projections of relative costs of transportations may be obtainable by surveying selected firms in the maritime industry or by consulting the Maritime Administration. Third, they may also be obtained through surveys of the users of transportation services, e.g. shippers.

Standard errors of the forecasts so obtained may be computed in a strictly analogous fashion as in Section 4.5 and will not be repeated here.

4.7. Mode Allocation

Given the total weight of imports, exports, receipts or shipments of the i th commodity group at the j th port that is transported by water, it is necessary to further allocate these by mode. Four separate modes are distinguished: Containerized, General Cargo, Dry Bulk, and Liquid Bulk.

The method of allocation is strictly analogous to that of air-land-water allocations except that there are now in principle three equations to be estimated rather than two. However, very often one or more of the modes will be inapplicable. To implement the procedure outlined in Section 4.6, a time series of shipping weights by mode by commodity and port is necessary.

The projection procedure is also analogous to the projection of air-land-water weights. The projections of total weight transported by water obtained in Section 4.6 are used as inputs here. We also need, of course, projections of the costs per metric ton-mile of transportation by each of the four modes. Again, these may be generated by trend line projections, or obtained through surveys of the maritime industry, or surveys of the users of maritime industry services.

4.8. Determination of the Origin of Imports

Given the total constant 1967 U.S. dollars quantity of the imports of the i th commodity at the j th port, one can determine the allocation of these imports amongst the supplying countries by the following model of B. G. Hickman and L. J. Lau.¹ Let X_k^{ij} be the exports of the i th commodity to the j th port by the k th country. Let X_{k0}^{ij} be the base year constant 1967 U.S. dollars quantity of X_k^{ij} . Let α_{k0}^{ij} be the base year share of the k th country's exports of the i th commodity to the j th port in the total imports of the i th commodity at the j th port, that is:

$$\alpha_{k0}^{ij} = \frac{X_{k0}^{ij}}{\sum_k X_{k0}^{ij}}.$$

Then given $M^{ij} \equiv \sum_k X_k^{ij}$, X_k^{ij} is given by:

$$X_k^{ij} = \alpha_{k0}^{ij} M^{ij} - \sigma_j X_{k0}^{ij} (p_k^{ij} - p_m^{ij}) + \gamma_k^{ij} t, \quad k=1, \dots, n,$$

with the property that $\sum_k \gamma_k^{ij} = 0$. Ideally, the p_k^{ij} 's, which are indexes of export prices of the k th country, should be measured in U.S. dollars (and hence reflect any exchange rate changes), and should be measured in c.i.f. terms and include tariff charges per unit constant dollar quantity of the commodity. However, c.i.f. data may be difficult to find and tariff data by commodity groups on a time series basis are

¹B. G. Hickman and L. J. Lau, "Elasticities of Substitution and Export Demands in a World Trade Model," European Economic Review, Vol. 4, 1973, pp. 347-380.

similarly difficult to locate. Thus often one is forced to use f.o.b. prices for this purpose, assuming that the c.i.f. price is a constant proportional markup from the f.o.b. price, irrespective of the origin of the imports (and hence independent of the distance traveled).

Three peculiarities of this system are worthy of note. First, σ_j is the same coefficient for all k countries, and therefore the system of equations should be estimated jointly. The actual equations that will be estimated are the following:

$$X_{kt}^{ij} - \alpha_{k0}^{ij} M_t^{ij} = \sigma_j (-X_{k0}^{ij} (p_{kt}^{ij} - p_{mt}^{ij})) + \gamma_k^{ij} t, \quad k=1, \dots, n-1; \\ t=1, \dots, T.$$

Notice that in the base year, the price indexes are identically one and t is zero, and the equation reduces to an identity. Second, because of the adding-up property, only $(n-1)$ equations need be estimated. The coefficients of the remaining equations can be derived from the coefficients of the $(n-1)$ equations. In terms of our application, we can drop the equation corresponding to imports from the rest of the world, that is, from countries whose individual shares in the total for the i th commodity in the j th port fall below 5 percent or 10 percent as the case may be. Third, there may be a slight discrepancy between $\sum_k X_k^{ij}$ and M^{ij} in constant 1967 U.S. dollars terms because of the way in which they are derived. The constant-dollar total obtained by direct deflation with the price index as in Appendix 3 will not in general be the same as the sum of the constant dollar quantities deflated individually. However, the discrepancy is likely to be small, and for our application, the discrepancy will be absorbed by the n th country, that is, the rest of the world.

To allocate a given projection of total imports among the supplying countries, we need projections of the price indexes. The latter may be obtained either through trend line projections, or through extraneous estimates.

The model that we consider can be substantially simplified if the j superscripts are dropped from the price indexes. That amounts to assuming that prices of imports do not differ according to the port of entry. One may further simplify by dropping the j subscript from σ_j and the j superscript from γ_k^{ij} . This amounts to assuming that the relative pattern of import allocation among supplying countries is the same for all port systems. Finally, one can set $\sigma_j = 0, \forall j$. This amounts to assuming that prices have no effect. There is zero elasticity of substitution among the supplying countries. Although this is a strong assumption, it does have the advantage of not requiring any price data either for estimation or for projection purposes. It also obviates the need for making assumptions about future exchange rate movements.

After the constant dollar quantities for each supplying country is projected, one can convert this to weight in direct proportion. For instance, if projected total weight from Section 4.5 is W^{ij} , then

$$\hat{W}_k^{ij} = \frac{\hat{W}^{ij} \hat{x}_k^{ij}}{\hat{M}^{ij}}, \quad k=1, \dots, n.$$

As before $\hat{W}_n^{ij}$ is obtained as a residual.

$$\hat{W}_n^{ij} = \hat{W}^{ij} - \sum_{k=1}^{n-1} \hat{W}_k^{ij}.$$

Similarly, one may allocate this weight proportionately by methods and modes of transportation. Some caution and judgment must be exercised in the allocation by method, as some methods, such as land transportation, may not be available to some supplying countries, such as Japan. An adjustment procedure is outlined in Appendix 11.

This proposed weight allocation procedure assumes that weight characteristics are uniform across the supplying countries. An alternative that dispenses with this assumption is to estimate separate weight conversion functions for each commodity at each port for each supplying country. That is a substantial data processing task and does not appear justified unless there is strong reason to suspect nonuniformity in the weight characteristics.

4.9. Determination of the Destination of Exports

Given the total constant 1967 U.S. dollars quantity of the exports of the i th commodity from the j th port, one can determine the allocation of the exports amongst the using countries by the following model. Let m_k^{ij} be the imports of the i th commodity from the j th port to the k th country. Let m_{k0}^{ij} be the base year constant dollar quantity of m_k^{ij} . Let

$$\beta_{k0}^{ij} = \frac{m_{k0}^{ij}}{\sum_k m_{k0}^{ij}}.$$

Let X^{ij} be the total constant 1967 U.S. dollars quantity of exports of the i th commodity from the j th port. Then the m_k^{ij} 's are given by a set of allocation functions:

$$m_k^{ij} = \beta_{k0}^{ij} X^{ij} + \sigma_k^{ij} (p_{m,k}^i - p_w^i) + \gamma_k^{ij} t, \quad k=1, \dots, n-1,$$

where $p_{m,k}^i$ is the import price of the i th commodity in the k th country, p_w^i is the world price of the i th commodity, all measured in terms of U.S. dollars. There are two reasons why we only estimate $(n-1)$ equations. First, they are not all stochastically independent. Second, in order to achieve adding up, we have to make the last equation a residual. Following the practice in Section 4.8, we only distinguish countries separately if their base year shares exceed five or ten per cent of the total. Otherwise they are put in the rest of the world category.

For estimation purposes it is necessary to transfer $\beta_{k0}^{ij} X^{ij}$ to the left-hand-side. Thus, the estimating equation looks like:

$$m_k^{ij} - \beta_{k0}^{ij} X^{ij} = \sigma_k^{ij} (p_{m,k}^i - p_w^i) + \gamma_k^{ij} t, \quad k=1, \dots, n-1.$$

As in previous cases, this equation can be simplified by dropping the price variables. Alternatively, one can also estimate the equations:

$$m_k^{ij} = \xi_k^{ij} + \eta_k^{ij} X^{ij} + \gamma_k^{ij} t, \quad k=1, \dots, n-1.$$

4.10. Domestic Origin of Exports and Destination of Imports

So far we have not discussed the issue of allocating the total imports, exports, receipts and shipments of a given commodity at a given port system to its ultimate domestic origins and destinations. If a time series of origin and destination data are available, it is possible to estimate sets of allocation functions similar to those used in Section 4.9, starting from some base year shares. For imports, the allocation functions will be functions of the destination real disposable income, intermediate demand, population and time. For exports, the allocation functions will be functions of the origin real disposable income, net output, population and time. Net output is, of course, gross output less the intermediate demand from the other industries and can be calculated with the help of input-output tables. As before, there will be a residual origin and residual destination which will assure adding up by absorbing the statistical discrepancies.

If a time series of origin and destination data are unavailable, the allocation may still be done on the basis of fixed shares, or trended shares.

A study of domestic origin and destination is important to the evaluation of the competitiveness among the West Coast port systems. The appropriate comparison of transportation costs must be the total costs of transportation from the ultimate origin to the ultimate destination, not just from the origin (for imports and receipts) or destination (for exports and shipments) to the U.S. West Coast.

Availability of origin and destination data remains to be established. There are a few studies which may be used as the basis

for application of the fixed shares method or the trended shares method. They include a 1956 study, a 1965 study, a 1970 study by the Department of Transportation and published by the Bureau of the Census. Studies made by the Bank of America on origin and destination for the 1960's may also contain some useful data although they do not cover the whole U.S. West Coast.

5. Extraneous Information

Although the methodology of this study relies heavily on multiple regression techniques, it utilizes also a great deal of extraneous information, and it is sufficiently flexible so that additional extraneous information may be introduced either as a substitute or a supplement to our procedure at any level within this study. Extraneous information does not mean that the information is not relevant. It just means that the information is not generated from the study.

Extraneous information that are used systematically include:

- (1) 1980 OBERS projections of personal income, population, industrial outputs and employments by BEA areas;
- (2) 1963 and 1980 input-output coefficients.

Other extraneous information that may be used include:

- (1) Forecasts of domestic and world price movements;
- (2) Forecasts of imports of U.S. trading partner countries;
- (3) Forecasts of relative prices and relative usage of alternative methods and modes of transportation.

Finally, there is also extraneous information which supplements our lack of historical experience. Thus, projections of trade with Indonesia, People's Republic of China, and U.S.S.R. may rely more heavily on the judgment of specialists than on the historical data. Likewise the receipts of oil from Alaska cannot be predicted on the basis of historical data alone. Judgmental forecasts are required.

6. Consistency Checks

In this type of projection exercises, when it is required to predict the values of certain variables in the future partly on the basis of current trend behavior, it is quite possible to obtain implausible or nonsensical results. Thus, our projections must be subject to some kinds of consistency checks.

The first kind of consistency checks makes use of our knowledge of the boundary values. For instance, the projections of imports, exports, receipts and shipments must be nonnegative. The projected allocations amongst the methods and modes of transportation must also be nonnegative. If any of these boundary values are violated, then either the specification of the prediction equation has to be reconsidered, or it has to be suppressed and the projection is done through some kind of judgmental forecast.

The second kind of consistency checks makes use of our knowledge of the economic feasibility of certain values. For instance, the imports of oil through the U.S. West Coast cannot exceed total projected Middle East oil production. The exports of wheat cannot exceed total projected U.S. domestic production less consumption. The imports of certain items cannot exceed a certain percentage of total U.S. demand either because of the existence of import quotas or the threats of import quotas and/or tariffs. Thus, whenever the projections look too large, relative to either the supply conditions or the demand conditions, they ought to be reexamined quite carefully.

The third kind of consistency check makes use of the projections of the national economy made by other government agencies or economists.

These act as a kind of control total. For instance, projected total U.S. West Coast imports for any commodity group cannot exceed total projected U.S. imports for that commodity group. In fact, the former projections should fall substantially below the latter. Based on the historical experience, it is possible to form judgments on the plausibility of these projections.

7. Sensitivity Analysis

Sensitivity analysis is needed to evaluate the degree of robustness of our projections--whether slight changes in the assumptions will lead to small or large changes in the projections. It can also be used to obtain alternative projections under alternative sets of hypothetical circumstances.

In terms of our study here, we can evaluate the sensitivity of our analysis with respect to three types of assumptions. First, our projections are undoubtedly sensitive with respect to the basic maintained assumption of our methodology, namely, that the imports and exports are both demand determined, and to the extent that supply factors are important, they are manifested through and only through the price variable. This rules out phenomena of non-price rationing and quota. There are two possible ways in which this assumption may be relaxed, on both the imports and the exports sides. One can project total supply of the commodity, and then project the price as a function of the total supply. One can in particular choose that price which clears the market. This yields an alternative price projection which can be used in the projection of imports and exports. Alternatively, one can introduce some rationing assumptions which do not work through the price variable exclusively. For instance, one can make imports a function also of either the total world exports of that commodity or the weighted sum of supplying countries' exports. Thus, it is possible to evaluate the sensitivity of our analysis to changes in this assumption at the cost of a slight complication in our analysis.

Second, it is possible to evaluate the sensitivity of our analysis with respect to the extraneous information that is used. This includes projections of the independent variables, prices, incomes, industrial outputs, imports of foreign countries, etc. It also includes such items as input-output tables, mode use tables, exchange rates, insurance and freight rates, tariffs. Our projections will be sensitive to changes in any one of the above items.

Finally, one can in principle also evaluate the sensitivity of our analysis to our simplifying assumptions, such as the decomposability of our weight conversion and method and mode allocation, the exclusion of certain independent variables because data on them are not available, the assumption of uniformity of certain coefficients across the categories of imports, exports, receipts and shipments, and across port systems. Evaluation in this case, however, implies redoing the whole analysis in more general terms. This will greatly increase the complexity of the analysis and the data requirements. So unless there is a strong prior knowledge that the simplifying assumptions are obscuring the true picture, such a general approach is not recommended.

8. Schedule

August 31, 1974:	Completion of Study Plan.
December 31, 1974:	Completion of Data Collection.
April 30, 1975:	Completion of Statistical Analysis.
June 30, 1975:	Preliminary Report.
November 30, 1975:	Draft Final Report.
December 31, 1975:	Final Report.

APPENDIX 1

Commodity Groups Distinguished

<u>Waterborne Commerce Classification</u>	<u>Standard Industrial Classification (SIC)</u>	<u>Standard International Trade Classification (SITC)</u>
1. Farm Products	01	
2. Forest Products	08	
3. Metallic Ores	10	
4. Coal	11	
5. Crude Petroleum	13	
6. Non-Metallic Minerals	14	
7. Food and Kindred and Tobacco	20 & 21	
8. Textiles	22	
9. Apparel	23	
10. Lumber & Wood Products & Furniture	24 & 25	
11. Pulp, Paper and Allied Products and Printed Matter	26 & 27	
12. Chemical and Allied Products	28	
13. Petroleum and Coal Products	29	
14. Rubber and Plastics Products	30	
15. Leather Products	31	
16. Stone, Clay, Glass	32	
17. Primary Metals	33	
18. Fabricated Metal Products & Ordnance	34 & 19	
19. Machinery, Non-Electrical	35	
20. Machinery, Electrical	36	
21. Transportation Equipment	37	
22. Instruments	38	
23. Miscellaneous Products of Manufacture	39	
24. Waste and Scrap	40	
25. Special Items	41	
26. DOD	99	

APPENDIX 2

Hinterland BEA Areas of the Regional Port Systems

- (1) Upper Pacific Northwest
 - 1.1. Spokane (#154)
 - 1.2. Seattle-Everett (#155)
 - 1.3. Butte, Montana (#153)
- (2) Lower Pacific Northwest
 - 2.1. Yakima, Washington (#156)
 - 2.2. Portland (#157)
 - 2.3. Eugene (#158)
 - 2.4. Boise, Idaho (#159)
 - 2.5. Idaho Falls (#152)
- (3) Northern California
 - 3.1. Stockton (#167)
 - 3.2. Sacramento (#168)
 - 3.3. Redding (#169)
 - 3.4. Eureka (#170)
 - 3.5. San Francisco-Oakland (#171)
 - 3.6. Reno (#160)
 - 3.7. Salt Lake City (#151)
- (4) Southern California
 - 4.1. Los Angeles-Long Beach (#165)
 - 4.2. Fresno (#166)
 - 4.3. Las Vegas (#161)
 - 4.4. Phoenix (#162)
 - 4.5. Tucson (#163)
 - 4.6. El Paso (#145)
 - 4.7. Albuquerque (#146)
- (5) Alaska
 - 5.1. Anchorage (#172)
- (6) Hawaii
 - 6.1. Honolulu (#173)

APPENDIX 3

Construction of Constant 1967 U.S. Dollar Quantities
of Imports by Commodities and by Port Systems

To construct a constant 1967 U.S. dollars quantity of import for the i th commodity group in the j th port we make use of a 1967-based import price index of the i th commodity group at the j th port. The construction of this import price index is described in Appendix 4. Let V^{ij} be the total value of imports in current U.S. dollars of the i th commodity group at the j th port. Then M^{ij} , the constant 1967 U.S. dollars quantity of imports is given by:

$$M^{ij} = \frac{V^{ij}}{p^{ijm}} .$$

We note that in the base year $P^{ijm} \equiv 1$. Thus the constant dollar imports and current dollar imports are identical in 1967, the base year, as one expects.

APPENDIX 4

Construction of the Import Price Indexes
by Commodities and by Port Systems

There are many alternative ways to construct price indexes. We consider only three possibilities.

The first is the most well known--the so-called Laspeyres' index. Basically, it is the weighted average of prices with base year expenditure shares as weights. Let p_k^{ij} be the price index in U.S. dollars of imports of the i th commodity at the j th port from the k th country with base year 1967. Let α_{k0}^{ij} be the share in value terms of the k th country imports of the i th commodity at the j th port in the base year (1967). Then the import price index is given by:

$$P^{ijm} = \sum_k \alpha_{k0}^{ij} p_k^{ij}.$$

Since $\sum_k \alpha_{k0}^{ij} = 1$, being the sum of the shares, $P^{ijm} = 1$ in the base year.

The second is the Paasche's index. Let α_{kt}^{ij} be the share in value terms of the k th country's imports at time t . Then

$$(P_t^{ijm})^{-1} = \sum_k \alpha_{kt}^{ij} (p_{kt}^{ij})^{-1}.$$

In other words, it is the harmonic mean of the price indexes with current value shares as weights. As in the case of the Laspeyres' index, $P_0^{ijm} \equiv 1$.

The third is the Divisia index. It is defined in differential form:

$$\frac{\dot{p}^{ijm}}{p^{ijm}} = \sum_k \alpha_{kt}^{ij} \cdot \frac{\dot{p}_k^{ij}}{p_k^{ij}}.$$

In other words, the percentage change of the import price index from one period to the next is equal to the weighted sum of the percentage changes in the individual import prices. Divisia indexes have to be constructed in the form of a chain. Given a selected base year, we first determine the price index for year 1, and then the price index for year 2, etc.

Of the three indexes, the Divisia index is the most desirable one to use from a theoretical point of view, but it also involves the most computation. As far as the data requirements are concerned, the Laspeyres' index appears to be the least demanding. Consequently as a first attempt, we shall use the Laspeyres' index in this study. We note also that we can simplify data requirements substantially if we are willing to make the assumption that $p_k^{ij} = p_k^i$, $\forall j$; that is, the import price indexes are independent of the destination port system.

APPENDIX 5

Construction of Regional Price Indexes

It is necessary to construct a price index of each commodity group and a general price index of consumption for each of the six regions. The index of cost-of-living, adjusted to a 1967 base year, is a good proxy variable for the general price index of consumption. This index, as well as the price index of the individual commodity groups, is available on the BEA area level through the corresponding SMSA (Standard Metropolitan Statistical Area) data. However, four of our regions consist of more than one BEA area. Consequently, it is necessary to aggregate these SMSA price indexes into a single index for the region.

If total consumption data are available for each BEA area, one can aggregate the general price indexes using the consumption shares as weights. If the base year weights are used, we have the Laspeyres' index,

$$P_c^j = \sum_k w_0^{jk} P_c^{jk},$$

where

$$w_0^{jk} \equiv \frac{P_0^{jk} C_0^{jk}}{\sum_k P_c^{jk} C_0^{jk}}$$

$$\equiv \frac{C_0^{jk}}{\sum_k C_0^{jk}}$$

because the price indexes are identically one in the base period.

Alternatively, one can use the Paasche's index,

$$(P_c^j)^{-1} = \sum_k w^{jk} (P_c^{jk})^{-1}.$$

Or finally, the Divisia index:

$$\frac{\dot{P}_c^j}{P_c^j} = \sum_k w^{jk} \frac{\dot{P}_c^{jk}}{P_c^{jk}}.$$

All these indexes are precisely analogous to those described in Appendix 4.

However, consumption data may not be available for the BEA areas. In that case we use total income share weights--the assumption being that the average propensity to consume is constant and identical across BEA areas. Thus, we have:

$$w^{jk} = \frac{Y^k}{\sum Y^k}$$

and

$$w_0^{jk} = \frac{Y_0^k}{\sum Y_0^k},$$

where Y^k is the total (not per capita) personal income (preferably disposable income) of the k th region in current U.S. dollars. Using these alternative weights, one can similarly compute the Laspeyres', Paasche's, and Divisia indexes. For our application, the Laspeyres' index will be used because of its relative computational simplicity and data economy.

The regional price indexes of the individual commodity groups may be similarly computed. Most likely, the consumption shares of each region in the total consumption of a given commodity group will not be available. Therefore we should be prepared to use the income shares weights as discussed above.

APPENDIX 6

Construction of the Intermediate Demand Variable

The intermediate demand variable for the i th commodity is constructed with the aid of an input-output table. Ideally, one should have a table for each year. If tables are only available for a few selected years, it is possible to use an interpolation technique to obtain tables for the intervening years. But very often only one table is available, and it is necessary to use the same table for all the years. This amounts to assuming that the technology is constant.

The intermediate demand for the i th commodity at the j th port system is constructed as:

$$Z^{ij} = \sum_k A_{ik}^j X_k^j, \quad \forall i,$$

where A_{ik}^j are the input-output coefficients applicable to the j th port system and X_k^j is the gross output of industry k in the hinterland of the j th regional port system. It is assumed that the input-output tables have already been aggregated up to the desirable classifications. We note that a time series of the gross outputs of the individual industries in the j th region is required for the computation of the intermediate demand variable.

If a time series of gross outputs for individual industries is unavailable, but employment is available, it is possible to construct an alternative intermediate demand variable. Let ℓ_i^j be the labor

required per unit gross output of the i th commodity in the j th region. Thus, ℓ_i^j is the labor coefficient. Let E_i^j be the employment of the i th industry in the j th region. Then the gross output of the i th industry is implicitly given as E_i^j / ℓ_i^j and the intermediate demand variable may be constructed as:

$$\begin{aligned} Z^{ij} &= \sum_k A_{ik}^j X_k^j \\ &= \sum_k A_{ik}^j \frac{E_k^j}{\ell_k^j} \\ &= \sum_k \left(\frac{A_{ik}^j}{\ell_k^j} \right) E_k^j. \end{aligned}$$

As before, the labor coefficients have to be aggregated to the desirable industrial classification. Aggregation of input-output tables is described in Appendix 7.

APPENDIX 7

Aggregation of Input-Output Tables

The input-output tables of the individual Western states constructed by Dr. Karen Polenske for 1963 and the input-output table for the U.S. constructed by the Bureau of Labor Statistics and projected up to 1980 distinguish many more industries than the present study. In the Polenske tables, there are 79 industries distinguished. In the Bureau of Labor Statistics table, there are industries distinguished. For our purposes, it is necessary to aggregate these tables into a 26 industries classification.

The very first task of aggregation is to establish a correspondence between the 26 industries that we distinguish and the industries that the Polenske and the BLS tables distinguish. This correspondence is provided in Appendix 8.

In addition to the input-output tables, we also need the values of the gross outputs of each industry in the year of the respective tables. Then one can proceed to aggregate the input-output tables. The basic principle behind aggregation is the definition of an input-output coefficient. A coefficient A_{ij} is the quantity of the i th commodity required per unit gross output of the j th commodity. When we aggregate across industries, four things happen:

First, total gross output of the new industry is the sum of the gross outputs of the old industries being aggregated.

Second, total requirements of the i th commodity, assuming that the i th commodity is not being aggregated, is the sum of the requirements

of the individual old industries. The requirements of the i th commodity by the j th industry is $A_{ij}X_j$ where X_j is the gross output of the j th industry. Thus, total requirements of the i th commodity is equal to

$$\sum_j A_{ij}X_j$$

where j ranges over the industries being aggregated. The aggregated input-output coefficient is therefore:

$$A_{ij}^* = \frac{\sum_j A_{ij}X_j}{\sum_j X_j}.$$

Third, total requirements of the aggregated industry's output by the industry itself is given by:

$$\sum_{j'} \sum_j A_{j',j}X_j$$

where j' and j both range over the industries being aggregated. The aggregated input-output coefficient is therefore:

$$A_{jj}^* = \frac{\sum_{j'} \sum_j A_{j',j}X_j}{\sum_j X_j}.$$

Fourth, the requirements of the aggregated industry's output by the i th industry, which is not being aggregated, is given by:

$$\sum_j A_{ji}X_i = (\sum_j A_{ji})X_i.$$

Thus, the new input-output coefficient is given by:

$$A_{ji}^* = \frac{(\sum_j A_{ji})X_i}{X_i}$$

$$= (\sum_j A_{ji}),$$

or just the simple sum of the original input-output coefficients.

We conclude this appendix by way of a simple example. Let the input-output coefficients and gross output of a three-industry table be:

$$\begin{array}{ccc} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \\ X_1 & X_2 & X_3. \end{array}$$

Industries 2 and 3 are to be aggregated. The interindustry requirements in terms of the old industries are:

$$\begin{array}{ccc} A_{11}X_1 & A_{12}X_2 & A_{13}X_3 \\ A_{21}X_1 & A_{22}X_2 & A_{23}X_3 \\ A_{31}X_1 & A_{32}X_2 & A_{33}X_3. \end{array}$$

The interindustry requirements in terms of the new industries are:

$$\begin{array}{ccc} A_{11}X_1 & A_{12}X_2 + A_{13}X_3 & \\ A_{21}X_1 + A_{31}X_1 & A_{22}X_2 + A_{23}X_3 + A_{32}X_2 + A_{33}X_3 & . \end{array}$$

The new input-output coefficients and gross outputs are therefore:

$$A_{11} \quad \frac{A_{12}X_2 + A_{13}X_3}{X_2 + X_3}$$

$$(A_{21} + A_{31}) \quad \frac{(A_{22} + A_{32})X_2 + (A_{23} + A_{33})X_3}{X_2 + X_3}$$

$$X_1 \quad X_2 + X_3.$$

APPENDIX 8

Correspondence between Industries Distinguished and the Industries
in the Polenske and Bureau of Labor Statistics Tables

<u>Waterborne Commerce Classification</u>	<u>Polenske Industrial Classification</u>	<u>BLS Industrial Classification</u>
1. Farm Products		
2. Forest Products		
3. Metallic Ores		
4. Coal		
5. Crude Petroleum		
6. Non-Metallic Minerals		
7. Food and Kindred & Tobacco		
8. Textiles		
9. Apparel		
10. Lumber and Wood Products & Furniture		
11. Pulp, Paper and Allied Products & Printed Matter		
12. Chemical and Allied Products		
13. Petroleum and Coal Products		
14. Rubber and Plastics Products		
15. Leather Products		
16. Stone, Clay, Glass		
17. Primary Metals		
18. Fabricated Metal Products & Ordnance		
19. Machinery, Non-Electrical		
20. Machinery, Electrical		
21. Transportation Equipment		
22. Instruments		
23. Miscellaneous Products of Manufacture		
24. Waste and Scrap		
25. Special Items		
26. DOD		

APPENDIX 9

Construction of the Export Price Indexes and Constant Dollar
Exports by Commodities and by Port Systems

The export price indexes can be constructed in the same way as in previous appendixes on price indexes. It is a weighted average of the price indexes of the constituent commodities in the i th commodity group at the j th port.

As before, three separate indexes, the Laspeyre's, the Paasche's and the Divisia indexes can be constructed. The Laspeyre's index is recommended because it requires the least in terms of data inputs. Constant dollar exports is derived by deflation of the current value by the price index.

Alternatively, one may assume that the export prices are independent of the port system. In this case, aggregate U.S. export price data may be used to derive the price index.

APPENDIX 10

Construction of the Import Price Indexes and Constant Dollar
Imports of Trading Partner Countries by Commodities

The import price index of the i th commodity for the l th trading partner country may again be derived as a weighted average of the price indexes of the countries supplying the l th country. Let $p_{k\ell}^i$ and $m_{k\ell}^i$ be the price index and quantity of imports of the i th commodity by the l th country from the k th country respectively. Then the alternative price indexes may be defined as follows:

$$\text{Laspeyre's:} \quad p_{\ell,m}^i = \sum_k w_{k\ell}^i p_{k\ell}^i$$

$$\text{Paasche's:} \quad p_{\ell,m}^i = \left(\sum_k w_{k\ell}^i p_{k\ell}^{i-1} \right)^{-1}$$

$$\text{Divisia:} \quad \frac{\dot{p}_{\ell,m}^i}{p_{\ell,m}^i} = \sum_k w_{k\ell}^i \frac{\dot{p}_{k\ell}^i}{p_{k\ell}^i}$$

where $w_{k\ell}^i$ is the k th country's share in the l th country's value of imports of the i th commodity.

An alternative, simpler approach that does not make use of the compositional data of the imports is to take the import unit values by commodity groups published in the Yearbook of International Trade Statistics and aggregate them upwards into our commodity grouping.

Having constructed these price indexes, it is straightforward to derive constant dollar imports by deflation.

APPENDIX 11

Adjustment Procedure for Air-Land-Water Allocation by Origin When
Some Method of Transportation is Unavailable

We shall illustrate the adjustment procedure by way of an example. Using the proportional allocation procedure, for a three supplier world, we have:

Country	M e t h o d			
	Air	Land	Water	Total
1	X_{11}	X_{12}	X_{13}	W_1
2	X_{21}	X_{22}	X_{23}	W_2
3	X_{31}	X_{32}	X_{33}	W_3
Total	X_1	X_2	X_3	$\sum X_i = \sum W_i$

The problem is, given W_1, W_2, W_3 and X_1, X_2, X_3 , can we find X_{ij} , $i, j=1, \dots, 3$ such that the rows and columns sum to their respective totals? There are many ways that this can be done. With the proportionality assumption, however, the resulting matrix looks like:

$$\begin{array}{ccc}
 \rho_1 W_1 & \rho_2 W_1 & \rho_3 W_1 \\
 \rho_1 W_2 & \rho_2 W_2 & \rho_3 W_2 \\
 \rho_1 W_3 & \rho_2 W_3 & \rho_3 W_3
 \end{array}$$

where $\rho_i = \frac{X_i}{\sum_i X_i}$. It can be readily verified that this choice does satisfy the row and column totals.

Now consider restrictions of the type $X_{12} = 0$. We need to find a different set of numbers. In order not to upset the column total, we must add to X_{22} and X_{32} what is allocated to X_{12} . Moreover, we like to do this so that the relative proportions of X_{11} and X_{13} , X_{21} and X_{23} , and X_{31} and X_{33} remain unchanged. This implies the following equations:

$$X_{12}^* = 0$$

$$\frac{X_{11}^*}{X_{13}^*} = \frac{X_{21}^*}{X_{23}^*} = \frac{X_{31}^*}{X_{33}^*} = \frac{X_1}{X_3}.$$

$$\text{But } X_{11}^* + X_{12}^* + X_{13}^* = W,$$

$$X_3 X_{11}^* - X_1 X_{13}^* = 0.$$

Thus, one may choose:

$$X_{11}^* = \frac{\rho_1}{\rho_1 + \rho_3} W_1$$

$$X_{12}^* = 0$$

$$X_{13}^* = \frac{\rho_3}{\rho_1 + \rho_3} W_1.$$

We now reallocate column 2. We require that

$$\frac{X_{22}^*}{X_{23}^*} = \frac{W_2}{W_3}.$$

Thus:

$$X_{22}^* = \frac{W_2}{W_2 + W_3} \cdot X_2$$

$$X_{23}^* = \frac{W_3}{W_2 + W_3} \cdot X_2.$$

Finally, we determine the rest of the entries:

$$X_{21}^* = \frac{\rho_1}{\rho_1 + \rho_3} \cdot (W_2 - \frac{W_2}{W_2 + W_3} \cdot X_2)$$

$$X_{23}^* = \frac{\rho_3}{\rho_1 + \rho_3} \cdot (W_2 - \frac{W_2}{W_2 + W_3} \cdot X_2)$$

$$X_{31}^* = \frac{\rho_1}{(\rho_1 + \rho_3)} \cdot (W_3 - \frac{W_3}{W_2 + W_3} \cdot X_2)$$

$$X_{33}^* = \frac{\rho_3}{(\rho_1 + \rho_3)} \cdot (W_3 - \frac{W_3}{W_2 + W_3} \cdot X_2).$$

One can verify that this allocation does satisfy the row and column totals. The key principles to be observed in this procedure are first, to maintain proportionality between air and water transportation, and second, to allocate land transportation proportional to the relative shares in the total.

Suppose further X_{12}^* and X_{22}^* both have to be zero. Then we have:

$$X_{32}^* = X_2$$

$$X_{11}^* = \frac{\rho_1}{\rho_1 + \rho_3} W_1$$

$$x_{13}^* = \frac{\rho_3}{\rho_1 + \rho_3} W_1$$

$$x_{21}^* = \frac{\rho_1}{\rho_1 + \rho_3} W_2$$

$$x_{23}^* = \frac{\rho_3}{\rho_1 + \rho_3} W_2$$

$$x_{31}^* = \frac{\rho_1}{(\rho_1 + \rho_3)} (W_3 - X_2)$$

$$x_{33}^* = \frac{\rho_3}{(\rho_1 + \rho_3)} (W_3 - X_2).$$

It can again be verified that this allocation satisfies the row and column totals.

APPENDIX 12

Construction of Net Outputs of an Industry

Net output of each industry in each region may be measured with the help of the input-output tables. Let X_i be the gross output of the i th industry, let N_i be the net output of the i th industry. Then net output is given by:

$$N_i = X_i - \sum_j A_{ij} N_j,$$

where A_{ij} is the quantity of the i th industry output required per unit gross output of the j th industry and j ranges over all the industries.

The net output is an accurate measure of the ability of a given region to export. It is therefore used in the allocation of domestic origins of exports.

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